



# **INTERNATIONAL CONFERENCE ON EDUCATION, TECHNOLOGY, AND SCIENCE**

**Improving The Quality of Education  
To Face The Impact of Technology**

**University of Muhammadiyah Purwokerto**

**December 28<sup>th</sup>, 2013**

# **P R O C E E D I N G S**



Universitas Muhammadiyah Purwokerto  
Jl. Raya Dukuwaluh, PO BOX 202 Kembaran, Purwokerto  
Central Java, Indonesia 53182  
Ph. +62281 636751, 634424 | Fax. +62281 637239  
[www.nets2013.ump.ac.id](http://www.nets2013.ump.ac.id) | [www.ump.ac.id](http://www.ump.ac.id)

ISBN 978-602-14930-0-7

**International Conference on Education, Technology, and Science  
NETS 2013**

**Improving The Quality of Education to Face The Impact of Technology**

**PROCEEDINGS**

**Universitas Muhammadiyah Purwokerto  
Purwokerto, December 28<sup>th</sup>, 2013**

**Preface**  
**Rector of UMP**

Assalamu'alaikum wr. wb.

Alhamdulillah, that UMP will carry out prestigious event namely "National Olympiad and International Conference on Education, Technology, and Science (NETS) 2013" is a very great news for me. NETS 2013 is the first event which is conducted in collaboration between UMP and PWM Central Java. It is a great event which is constructively supported by ITB, UNiSA, UTeM, and several institutions under UMP partnership to smoothen the event.

Recently, technology grows very fast. This fast growth affects on the quality of education in Indonesia. Based on this condition, UMP and PWM Central Java formulate a program which later it is formed into "NETS 2013". This event is also a contribution to Islamic Higher Education Institution to prepare candidate of future leaders who have competitive skills to compete positively in comprehending knowledge and technology.

In NETS 2013, there are some events which are arranged in a sequence such as: International Conference on Education, Technology, and Science (ICETS) with Prof. Dr. Ir. Imam Robandi, M.T., Mr. Ganjar Pranowo, Mr. Simen Lourds, and Dr. Hiroshi Takeda; Seminar (Call for Paper) including some disciplines of science covering Education, Engineering, Medicine, Science, Social, Politic, Religion, Law, Culture, Arts, Agriculture, and Technology; National Olympiad for Student and Teacher (NOST) which is joined by students, teachers, and schools; and Expo. In NETS 2013 competitions, participants are fighting over trophies, medals, certificates, and advisory fund reaching up to Rp250.000.000,- ; furthermore, there is also a fellowship to study in UMP.

As the Rector of The University of Muhammadiyah Purwokerto, I do really expect that conducting this event could encourage all of us to be more advanced nation not only on economic side, but also on social life. It is also expected that this event will increase our awareness on how important it is to develop and advance technology in education.

That is all I could deliver now, for further information you may access our website on [www.ump.ac.id](http://www.ump.ac.id).

Last but not least, "Let's join and support NETS 2013 in UMP".

Wassalamu'alaikum wr. wb.

Purwokerto, 28<sup>th</sup> Decembe 2013

Rector,

Dr. H. Syamsuhadi Irsyad, M. H.

## **Preface**

### **The Chairman of NETS 2013**

Assalamualaikum, wr. wb.

Today is the valuable and precious milestones for education in Indonesia in general and Muhammadiyah in particular because all levels of education from elementary schools to university get together to build relationship and networking in the national Olympiad and international conference hosted by University of Muhammadiyah Purwokerto.

We deserve rejoice and pride because there are more than 1705 participants, 215 officials and 300 invited guests. This is also a great honour for University of Muhammadiyah Purwokerto to have the Governor of Central Java and the staffs, the regents from four regions and the staffs, the chief of Central Muhammadiyah Board , the Education division of Muhammadiyah Board, the directorate of higher education, Rectors of University of Muhammadiyah throughout Indonesia and rectors of universities in Purwokerto, companies and stake holders, media , travel biro as well as the colleagues, persistent fighters for Muhammadiyah in the region and territory.

As the chairman of this events, I'd like to report that there are more than 1616 teachers and students who will be joining the national Olympiad and there are more than 311 researchers, lecturers and students will be taking part in the International Conference. Again, I'd like to emphasis that this event is really a pride for us because the participants are coming representing five big islands in Indonesia, they are Sumatra, Kalimantan or Borneo, Java and Sulawesi.

This event holds thirty one types of competitions and organizing six international conferences. There are twenty five competitions for students, four competitions for teachers and three competitions for schools. The international conference covers fields of Educations, Engineering, Science and Agriculture, Health and Medicine, Culture and Arts, social, Politics, Economics, Religion and Law.

We are proud to mention that we have at least fifteen experts coming from higher education, one from high schools, two industries and one national research centre (LIPI). The experts and scholars are coming from some outstanding universities and institutes such as University of South Australia, Tottori University Japan, Institute Teknologi Melaka, Malaysia, Henderson Secondary School Singapore, Boromanjani College of Nursing Thailand, Surabaya Technology



Institute Bandung Technology Institute, Gadjah Mada University, Bogor Agriculture Institute, and University of Muhammadiyah Purwokerto.

On behalf of the committee, we'd like to express our deep gratitude and thanks to all sides for their sincere helps and supports that make this event possible to happen in UMP. Last but not least, we have tried and done our best in organizing this event, however, we realized that weaknesses and shortcomings may exist. And for that particular reason we'd like to apologize to you all. Hopefully, the next year NETS will be much better and much improved. Have a great competition and conference!

Wassalamualaikum wr.wb.

Purwokerto, 28<sup>th</sup> Decembe 2013

**The Chairman**

**Regawa Bayu Pamungkas, ST., MT.**

## Organizing Committee

The Responsible	: Dr. H. Syamsuhadi Irsyad, MH. (Rector of Universitas Muhammadiyah Purwokerto)
Steering Committee	: Prof. Dr. Ir. Imam Robandi, MT. (ITS) Prof. Dr. Din Syamsudin (PP Muhammadiyah) Prof. Dr. Baedowi (UNS) Dr. Syamsuhadi Irsyad, SH., MH. (Rektor UMP) Dr. Chairil Anwar (Dikti Litbang PP Muhammadiyah) Prof. Dr. DYP. Sugiharto (Koor.Kopertis Wilayah VI) Drs. Martono, M.Pd. (PWM Jawa Tengah) Prof. Dr. H.M. Daelamy SP. (PWM Jawa Tengah) Prof. Dr. Dodi Nandika (IPB) Prof. Dr. Abdullah (UNDIP) Prof. Dr. Masrukhi, M.Pd. (UNNES) Prof. Dr. Suparman Syukur (UIN WALISONGO) Dr. Ir. Danu Ariono (ITB) Prof. Dr. Djoko Wahyono, SU., Apt. (UGM) Prof. Dr. Rochadi Abdulhadi (LIPI) Prof. Dr. Kamaludin, M.Pd. (Staff Ahli Deputy Gubernur DKI) Prof. Dr. Imam Santoso, M.Si. (UNSOED) <i>Prof. Dr. Mifedwil Jandra Mohd. Janan</i> (UTM) Dr. Mariana binti Yusof (UTeM) Dr. Elvia Shauki (UNiSA)
Chair	: Ir. Regawa Bayu Pamungkas, MT.
Co-chair	: Watemin, SP., MP.
Program	: Anwar Ma'ruf, ST., MT. Santhy Hawanti, Ph.D. Juanita, ST., MT. Susanti, M.Phil., Apt. Agus Mulyadi, SP., MP. Khristanto, S.S., M.Hum. Naelati Tubastuvi, SE., M.Si.
Editor	: Sularso, Amd. Nur Afifah Indriyani

## **Keynote and Invited Speakers**

### **Keynote Speakers**

Prof. Imam Robandi (ITS, Indonesia)  
Mr. Simen Lourds (Singapore)  
Dr. Hiroshi Takeda (Tottori University, Japan)

### **Invited Speakers**

Elvia Shauki, Ph.D. (University of South Australia, Australia)  
*Prof. Dr.* Mifedwil Jandra Mohd. Janan (UTM, Malaysia)  
Pananut Wisawatapnimit (Boromarajonani College of Nursing, Bangkok, Thailand)  
Dr. Ir. Danu Ariono (ITB, Indonesia)  
Prof. Dr. Djoko Wahyono, SU., Apt. (UGM, Indonesia)  
Dr. Chairil Anwar (UGM, Indonesia)  
Prof. Dr. Rochadi Abdulhadi (LIPI)  
Prof. Dr. Sugeng Priyadi (UMP, Indonesia)  
Herman Soemantri, ST., M.Si. (PT. Pertamina)

## CONTENTS

Preface Rector UMP	ii
Preface Chairman NETS 2013	iii
Organizing Committee	v
Keynote and Invited Speakers	vi
EDUCATION	
THE IMPACT OF MULTI MEDIA TECHNOLOGY TO ENGLISH TEACHING Jusmin H.J Wahid, Universitas Ahmad Dahlan	1-5
THERE IS AN ELEPHANT IN MY ROOM:CHALLENGES IN TEACHING MULTIPLE LEVELSOF REPRESENTATION FOR CHEMISTRY PRESERVICE TEACHERS Muhamad Imaduddin, Muhammadiyah Semarang University	6-12
DEVELOPING A CHEMISTRY MAGAZINEAS A LEARNING RESOURCE OF YEAR-10 STUDENTS OF SENIOR HIGH SCHOOL Eko Yuliyanto, Muhammadiyah Semarang University	13-18
IMPROVING LEARNING OUTCOMES THROUGH THE APPLICATION OF COLLABORATIVE LEARNING MODEL DIRECT AND COOPERATIVE TYPE STAD ON MACROECONOMIC THEORY COURSES Luqman Hakim, Universitas Negeri Surabaya	19-24
EFL TEACHERS AND DIGITAL TEACHING MEDIA <sup>1</sup> Suwartono, <sup>2</sup> Asfi Aniuranti, <sup>1</sup> Muhammadiyah University of Purwokerto, <sup>2</sup> Gajah Mada State University of Yogyakarta	25-29
DEVELOPING A COMPREHENSION BASED INTERACTIVE READING MODEL Pudiyono, Muhammadiyah University of Purwokerto	30-37
DEVELOPMENT OF EXPERTISE COMPETENCY BASED PHYSICS PRACTICAL WORK ON THE FIELD OF MASONRY AND CONCRETE CONSTRUCTION ENGINEERING IN VOCATIONAL HIGH SCHOOL Ristiana Dyah Purwandari, Student of Science Education Doctoral Program, Indonesia University of Education	38-42
INCREASING THE LEARNING OUTCOMES AND THE CRITICAL THINKING THROUGH THE APPLICATION OF THE PROBLEM SOLVING APPROACH Riza Yonisa Kurniawan, Universitas Negeri Surabaya	43-47
THE LEARNING OF SPEAKING AND WRITING USING ICT ( INTERNET IN THE CYBER CLASSROOM ) FOR THE STUDENTS OF SENIOR HIGH SCHOOL Sony, Post Graduate Program of English Education, Ahmad Dahlan University	48-51
FIVE WAYS TO PROMOTE CREATIVITY IN THE CLASSROOM Ummu Rosyidah, Post Graduate Program of English Education, Ahmad Dahlan University	52-59

THE VALUE EDUCATION LEARNING IN FORMING CHILDREN BEHAVIOR, AGE 5-6 YEARS OLD Rohimi Zamzam	60-63
INITIATING CULTURAL-BASED CHARACTER LEARNING IN PRIMARY SCHOOL Masrukhi, Semarang State University	64-76
INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN HIGHER EDUCATION: AN INCONCLUSIVE FINDINGS Meika Kurnia Puji Rahayu D.A., University of Muhammadiyah Yogyakarta, Charles Darwin University	77-83
TEACHING AND LEARNING ENGLISH THROUGH UNIFORM RESOURCE LOCATOR (URL) STRATEGY Khamim Mustofa, SMP Muh 2 Kebumen	84-87
ANALOGICAL THINKING IN MATHEMATICS PROBLEM SOLVING Irwani, Muhammadiyah University of Gresik	88-92
SPEECH ON THE BEGINNING OF CHILDREN AGES 5 YEARS Perla Yualita, STIKes Aisyiyah Bandung	93-97
IMPROVING JUNIOR HIGH SCHOOL STUDENTS SCIENCE LITERACY BY USING MULT IMEDIA ON INTEGRATED-SCIENCE LEARNING IN THEME OF TRASH AND ITS TACKLING EFFORT Dewi Nurdiyanti, Banu Kisworo, Tania Avianda Gusman, Chemistry Departement, Teacher Training and Education Faculty University of Muhammadiyah Cirebon	98-102
ENGINEERING	
EFFECT OF TIME AND TEMPERATURE ON ULTRASOUND ASSISTED EXTRACTION OF ANTIOXIDANT FROM <i>Coleus tuberosus</i> Albertus Adrian Sutanto, Yustian Suharto, and Hadiyanto, Chemical Engineering Department, Faculty of Engineering, Diponegoro University	103-106
WASTE WATER TREATMENT IN TOFU INDUSTRY BY USING MICROALGAE <i>Nannochloropsis Sp.</i> Ali Makrup, Mutiara C and Widayat, Department of Chemical Engineering Diponegoro University	107-110
IMPROVING THE QUALITYOF BRIQUETTE FROM UTILIZATION OF SOLID WASTE OF FURFURAL SYNTHESIS PROCESS AS AN EFFORTS IN PROVIDING ALTERNATIVE ENERGY RESOURCES Mitarlis and Tukiran, Department of Chemistry, Faculty of Mathematics and Natural Sciences State University of Surabaya	111-115
FUZZY LOGIC AS THE CONTROLLER IN ELECTRONIC LOAD CONTROLLER SYSTEM M. Irfan, Machmud E., Nur Alif , M. Ilham P., Faculty of Engineering Department of Electrical Engineering Muhammadiyah University Malang	116-119

AUDIT DATA PROCESSING TOOL TO SUPPORT ENERGY CONSERVATION Galuh Prawestri Citra Handani, Rini Nur Hasanah, and Hadi Suyono, Electrical Engineering Department, Brawijaya University	120-125
FRACTIONAL DISTILLATION OF CLOVE OIL AT VACUUM PRESSURE Widayat, Muhammad Hilman H, Lily Nurdiana, Hadiyanto, Ngadiwiyana <sup>*)</sup> , Bambang Cahyono <sup>*)</sup> and Hantoro Satriadi Jurusan Teknik Kimia, Fakultas Teknik, Universitas Diponegoro, <sup>*)</sup> Jurusan Kimia Fakultas Sains dan Matematika Universitas Diponegoro	126-129
GOVERNOR MODEL USING FUZZY - PID CONTROLLER FOR LOAD FREQUENCY CONTROL GENERATOR Akhdad Ramadhani <sup>1)</sup> and Imam Robandi <sup>2)</sup> , Jurusan Teknik Elektro - FTI, Institut Teknologi Sepuluh Nopember Surabaya	130-133
DESIGN MODEL OF STATCOM USING PID CONTROLLER Ario P H <sup>1)</sup> , Hermansyah <sup>2)</sup> , Farid D M <sup>3)</sup> , Ratih M S <sup>4)</sup> , Imam Robandi <sup>5)</sup> , Institut Teknologi Sepuluh Nopember Surabaya	134-135
EXCITATION CONTROL SYSTEM DESIGN TO IMPROVE VOLTAGE STABILITY IN A SINGLE MACHINE INFINITE BUS SYSTEM (SMIB) METHOD USING PID Hermansyah, Aji Akbar Firdaus, Ratih Mar'atus Sholihah, Farid Dwi Murdianto, Imam Robandi, Electrical Engineering Institute of Technology Sepuluh Nopember	136-137
FREQUENCY STABILITY IMPROVEMENT ON SINGLE MACHINE SYSTEM USING FIRST ORDER POWER SYSTEM STABILIZER Nita Indriani Pertiwi <sup>1)</sup> , Mei Adetya <sup>2)</sup> , Andi Imran <sup>3)</sup> , Abil Huda <sup>4)</sup> , Imam Robandi <sup>5)</sup> <sup>(1,2,3,5)</sup> Institut Teknologi Sepuluh Nopember, Surabaya, <sup>(4)</sup> Universitas Borneo Tarakan, Kalimantan Utara	138-141
DESIGN AND DEVELOPMENT OF THE DC-TO-DC CONVERTER FOR HIGH POWER LED Mochammad Rif'an, Nanang Sulistiyanto, Rahmadwati, Onny Setyawati, Electrical Engineering Department, Brawijaya University	142-146
SETTLING TIME CONTROL OF STEAM TURBINE POWER PLANT USING LINEAR QUADRATIC REGULATOR (LQR) Ribka Stephani <sup>(1)</sup> , Nita I. Pertiwi <sup>(2)</sup> , Hidayatul Nurohmah <sup>(3)</sup> , Hilmansyah <sup>(4)</sup> dan Imam Robandi <sup>(5)</sup> <sup>(1,2,4,5)</sup> Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember (ITS) <sup>(3)</sup> Department of Electrical Engineering, Universitas Darul 'Ulum Jombang	147-150
IMPLEMENTATION OF ELECTRONIC LOAD CONTROLLER TO IMPROVE THE VOLTAGE QUALITY OF MICROHYDRO POWER PLANT AT BENDOSARI VILLAGE - PUJON - BATU OF EAST JAVA PROVINCE Rini Nur Hasanah, Teguh Utomo, and Nurussa'adah, Electrical Engineering Department, Brawijaya University	151-156
HYBRID POWER PLANT FEASIBILITY STUDY IN MANDANGIN ISLAND USING HOMER SOFTWARE Soeprapto <sup>1</sup> , Mahfudz Shidiq <sup>2</sup> , Unggul Wibawa <sup>3</sup> , <sup>1,2,3</sup> Department of Electrical Engineering Faculty of Engineering, Brawijaya University, Malang	157-162



APPLICATION OF COAL GASIFICATION AS SOURCE OF FUEL IN THE CARBONATION PROCESS OF LOCAL KOKAS BRIQUETE Wijianto <sup>1</sup> , Subroto <sup>2</sup> , Dwi Aries Himawanto <sup>3</sup> <sup>1,2</sup> Jurusan Teknik Mesin Fakultas Teknik Universitas Muhammadiyah Surakarta, <sup>3</sup> Jurusan Teknik Mesin Fakultas Teknik Universitas Sebelas Maret	163-166
GOVERNOR CONTROL MODEL DESIGN USING PID CONTROLLER IN STEAM POWER PLANT Aji Akbar Firdaus <sup>1</sup> , Ribka Stephani <sup>2</sup> , Hidayatul Nurohmah <sup>3</sup> , Nita Indriani P. <sup>4</sup> , Imam Robandi <sup>5</sup> <sup>1,4,5</sup> Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember Surabaya, <sup>2</sup> Universitas Kristen Petra, Surabaya, <sup>3</sup> Universitas Darul Ulum, Jombang	167-170
DESIGN AND DEVELOPMENT OF VACUUM DISTILLERFOR BIOETHANOL PRODUCTION Muhammad Aziz Muslim and Goegoes Dwi Nusantara, Electrical Engineering Department, Brawijaya University	171-173
MODELING AND SIMULATION OF STEERBY WIRE CONTROL SYSTEM USING FUZZY LOGIC Fachrudin <sup>1</sup> , Imam Robandi <sup>2</sup> , Nyoman Sutantra <sup>3</sup> <sup>1</sup> Electrical Engineering Dept., Widyagama Univ., Malang, <sup>2</sup> Electrical Engineering Dept., ITS Surabaya, <sup>3</sup> Mechanical Engineering Dept., ITS Surabaya	174-177
EIGENVALUE STABILITY ANALYSIS BASED ON VALUE GENERATOR EXCITATION SYSTEM MODEL ON SMIB Hilmansyah <sup>(1)</sup> , Mei Aditya <sup>(2)</sup> , Rahmat <sup>(3)</sup> dan Imam Robandi <sup>(4)</sup> <sup>(1,2,3,4)</sup> Jurusan Teknik Elektro, Institut Teknologi Sepuluh Nopember (ITS)	178-179
ANALYSIS OF BIDIRECTIONAL BUCK-BOOST CASCADE CONVERTER PERFORMANCE WITH STATIC LOAD USING PSIM Muhammad Taufiq Ramadhan,Dedet Chandra Riawan,Imam Robandi, Department of Electrical Engineering, Faculty of Industrial Technology, ITS	180-181
COS IDENTIFICATION AND DESIGN OF WATER TURBINE CONTROL WITH LQR METHOD Ratih Mar'atus S. <sup>(1)</sup> ,Aji Akbar F. <sup>(2)</sup> ,Ribka Stephani <sup>(3)</sup> ,Hidayatul Nurohmah <sup>(4)</sup> ,Imam Robandi <sup>(5)</sup> <sup>(1,2,5)</sup> Institute of Technology Sepuluh Nopember Surabaya (ITS), <sup>(3)</sup> Kristen Petra University, Surabaya, <sup>(4)</sup> Darul 'Ulum University, Jombang	182-186
DESIGN OF POWER SYSTEM STABILIZER BASED FUZZY CONTROLLER WITH STATE FEEDBACK FOR SINGLE MACHINE INFINITE BUS SYSTEM Tamaji, Imam Robandi, Department of Electrical Engineering, Faculty of Industrial Technology Sepuluh Nopember Institut of Technology	187-191
STABILITY ANALYSIS OF A POWER SYSTEM MODELING 2 AREA IN THE FORM OF STATE SPACE Abil Huda, Riski C. A. H., Akhmad Ramdhani and Imam Robandi, Jurusan Teknik Elektro – FTI, Institut Teknologi Sepuluh Nopember Surabaya	192-194

ANALYSIS OF POWER SYSTEM STABILIZER (PSS) PERFORMANCE ON SINGLE MACHINE INFINITE BUS (SMIB) USING PARTICLE SWARM OPTIMIZATION (PSO) ALGORITHM Hidayatul Nurohmah <sup>1)</sup> , Nita Indriani Pertiwi <sup>2)</sup> , Hilmansyah <sup>3)</sup> , Andi Imran <sup>4)</sup> , Imam Robandi <sup>5)</sup> <sup>1),2),4),5)</sup> Department of Electrical Engineering, Faculty of Industrial Technology, ITS, <sup>3)</sup> Politeknik Negeri Balikpapan	195-196
DESIGN AND DEVELOPMENT OF A BUILDING ENERGY AUDIT SOFTWARE Rini Nur Hasanah, Hadi Suyono, Wijono, and Moch Dhofir, Electrical Engineering Department, Brawijaya University	197-202
DEVELOPMENT OF LIBRARY CODES FOR PROGRAMMING THE HUMANOID ROBOT BASED ON CM-510 MODULE Muchlas and Ferry Yushmano, Department of Electrical Engineering, Universitas Ahmad Dahlan	203-207
ANALYSIS OF MINI HYDRO POWER AND PHOTOVOLTAIC INJECTION INTO THE GRID SYSTEM Hadi Suyono, Muhammad Fauzan E.P., Hari Santoso, Department of Electrical Engineering, Faculty of Engineering, Brawijaya University	208-212
EFFECT OF ETHANOL-96% IN GASOLINE WITH MIXTURE RATIO OF 1:9 AND 2:8 ON THE COMBUSTION AND EMISSION OF 125cc FOUR-STROKE ENGINE Dwi Fadila Kurniawan, Eko Siswanto, Erni Yudaningsy and Eka Maulana, Electrical Engineering Department, Brawijaya University	213-218
A STUDY ON THE PERFORMANCE AND EXHAUST EMISSIONS OF A DI CI ENGINE FUELLED WITH DIESEL/LPG BLENDS Munzir Qadri, Dept. of Mechanical Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta	219-225
BUILDING AND DESIGNING CHEAP TELECOMMUNICATION SYSTEM FOR TENAGA KERJA INDONESIA (TKI) Wahyu A. P., Teknik Elektro Fakultas Teknik Universitas Brawijaya	226-231
DC MOTOR SPEED CONTROL USING DYNAMIC LINEAR QUADRATIC REGULATOR (LQR) Dwi Ajiatmo <sup>1,2</sup> and Imam Robandi <sup>3</sup> <sup>1)</sup> Department of Electrical Engineering, Faculty of Industrial Technology ITS, <sup>2)</sup> Department of Electrical Engineering, Faculty Engineering of Darul 'Ulum University Jombang, <sup>3)</sup> Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya	232-234
OPTIMIZATION OF PID CONTROLLER AND DUAL INPUT POWER SYSTEM STABILIZER IN ELECTRICAL SYSTEM USING FIREFLY ALGORITHM Mhd Fanyand Imam Robandi, Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya	235-242
PERFORMANCE ANALYSIS OF TIME DIVISION MULTIPLEXING (TDM) FOR ANALOG SIGNAL THROUGH OPTICAL FIBER AND CONDUCTOR TRANSMISSION Sholeh Hadi Pramono, Sapriesty Nainy Sari, and M. Fauzan Edy Purnomo, Department of Electrical Engineering, Faculty of Engineering, Brawijaya University	243-247

ORGANIC SOLAR CELL BASED ON EXTRACTION OF PAPAYA ( <i>Carica papaya</i> ) AND JATROPHA ( <i>Ricinus communis</i> ) LEAVES IN DSSC (DYE SENSITIZED SOLAR CELL) Sholeh Hadi Pramono, Eka Maulana, M. Julius St., and Teguh Utomo, Department of Electrical Engineering, Brawijaya University	248-251
EFFECTS OF TIME AND TEMPERATURE OF POLY ETHER ETHER KETONESULFONATION (sPEEK) ON THE SOLUBILITY OF sPEEK IN DIMETHYLACETAMIDE Muhammad Mujiburohman, Nur Hidayati, HerryPurnama, Siti R. Nihayati, Vendi Kurniawan, and Muhammad F. Hakim, Department of Chemical Engineering Universitas Muhammadiyah Surakarta	252-254
PSS - SMIB SIMULATION USING PSIM & MATLAB SOFTWARE <sup>1)</sup> Andi Imran, <sup>2)</sup> Hilmansyah, <sup>3)</sup> Mei Adetya, <sup>4)</sup> Yonny, <sup>5)</sup> Imam Robandi <sup>1,3,4,5)</sup> Electrical Engineering Department ITS, <sup>2)</sup> Politeknik Balikpapan	255-257
RENEWABLE ENERGY DISTRIBUTED GENERATION AS A SMART SOLUTION FOR THE ENERGY CRISIS IN INDONESIA Ramadoni Syahputra <sup>1,2</sup> , Imam Robandi and Mochamad Ashari <sup>2</sup> <sup>1</sup> Department of Electrical Engineering, Faculty of Engineering, Universitas Muhammadiyah Yogyakarta, <sup>2</sup> Department of Electrical Engineering, Faculty of Industrial Technology, Institut Teknologi Sepuluh Nopember	258-262
DESIGN OF DC VOLTAGE REGULATOR CONTROLLED BY BOOST CONVERTER CLOSE LOOP SYSTEM WITH STATIC LOAD USING PSIM Abdil Jabbar Asyadili, Rodhi Kelvianto, Muhammad Taufiq Ramadhan, Imam Robandi, Department of Electrical Engineering, Faculty of Industrial Technology, ITS	263-264
IMPLEMENTATION OF ARITIFICIAL NEURAL NETWORK ALGORITHM AND PREPROCESSING WITH SOBEL ALGORITHM Nurvelly Rosanti and Nera Kholimah, Informatic Engineering Course, Faculty of Engineering, University of Muhammadiyah Jakarta	265-273
PREDICTION OF TEST ITEMS VALIDITY USING ARTIFICIAL NEURAL NETWORK Hindayati Mustafidah <sup>1)</sup> , Sri Hartati <sup>2)</sup> , Retantyo Wardoyo <sup>3)</sup> , Agus Harjoko <sup>4)</sup> <sup>1)</sup> Informatics Engineering-Muhammadiyah University of Purwokerto (Computer Science Doctoral Student-FMIPA-Gadjah Mada University), <sup>2,3,4)</sup> Computer Science-FMIPA-Gadjah Mada University	274-279
PERFORMANCE ANALYSIS OF CLASSIFICATION ALGORITHM OF DATA MINING TO STUDENTS STATUS IN HIGHER EDUCATION Imam Tahyudin, Azhari Shouni Barkah, Department of Information System, STMIK AMIKOM Purwokerto	280-285
FREQUENCY AND VOLTAGE CORRECTION IN SINGLE MACHINE SYSTEM USING LINEAR QUADRATIC GAUSSIAN FEED BACK Farid Dwi M. <sup>(1)</sup> , Ratih Mar'atus S. <sup>(2)</sup> , Aji Akbar F. <sup>(3)</sup> , Ribka Stephani <sup>(4)</sup> , Imam Robandi <sup>(5)</sup> <sup>(1,3,5)</sup> Tenth of November Institute of Technology (ITS), <sup>(3)</sup> Christian of Petra University, Surabaya	286-289

ANALYSIS CONTROLLABILITY, OBSERVABILITY, STABILITY IN SMIB BY GOVERNOR Mei Adetya Praja, Abil Huda, Yoni Wicaksono, and Imam Robandi, Department of Electrical Engineering-Faculty of Industrial Technology, Institute of Technology Surabaya (ITS)	290-291
ANALYSIS OF MYCROHYDRO POWER PLANT SYSTEM USING COS Riski Cahya Anugraha Haebibi <sup>(1)</sup> , Ario P.H <sup>(2)</sup> , Akhmad Ramadhani <sup>(3)</sup> , Hermansyah <sup>(4)</sup> , Imam Robandi <sup>(5)</sup> , Electrical Engineering Department-FTI, Institut Teknologi Sepuluh Nopember ITS	292-294
OLTC TRANSFORMER USING AVR WITH FUZZY LOGIC CONTROL Yonny Wicaksono, Imam Robandi, Jurusan Teknik Elektro ITS, Surabaya	295-296
OPTIMAL FUZZY LOGIC CONTROLLER PADA PRESSURIZED WATER REACTOR (PWR) PEMBANGKIT LISTRIK TENAGA NUKLIR MENGGUNAKAN CUCKOO SEARCH ALGORITHM Prima Dewi Permatasari <sup>1)</sup> , Agus Dharma <sup>2)</sup> , Imam Robandi <sup>3)</sup> <sup>1,3)</sup> Jurusan Teknik Elektro, Fakultas Teknologi Industri, Institut Teknologi Sepuluh Nopember (ITS), <sup>2)</sup> Jurusan Teknik Elektro, Fakultas Teknik, Universitas Udayana, Denpasar – Bali	297-303
MANAJEMEN ALIRAN DAYA PADA SISTEM PENGGERAK ELEKTRIK MOTOR INDUKSI BERBASIS MULTILEVEL INVERTER JEMBATAN-H BERTINGKAT UNTUK APLIKASI MOBIL MATAHARI (SOLAR CAR) Muhamad Otong, Dedet Candra Riawan, Imam Robandi, Teknik Elektro-ITS Surabaya	304-309
HEALTH AND MEDICINE	
TRADITIONAL AND NEW COMPLEMENTARY THERAPY OF NURSING Panarut Wisawatapnimit, Boromarajonani College of Nursing, Bangkok, Thailand	310-316
EFFECTIVENESS OF ACUPRESSURE MASSAGE TOWARD CHANGE OF MOOD DURING THE MENSTRUAL PERIODS Agustina Ari Handayani, Nursing Program of An Nur Health School, Purwodadi-Grobogan	317-320
DESCRIPTION OF KNOWLEDGE ABOUT BREAST FEEDING CONTRACEPTION DURING LACTATION IN MIDWIFE CLINIC OF MRS. MINARTI PRINGAPUS VILLAGE PRINGAPUS DISTRICT SEMARANG REGENCY Rinta Nursanti, Eko Mardiyarningsih, Eka Adimayanti, Ngudi Waluyo Nursing Academy	321-323
THE DEVELOPMENT OF INTEGRATIVE MEASUREMENT MODEL OF PATIENT SAFETY CLIMATE OF HOSPITAL IN DKI JAKARTA, 2013 <sup>1</sup> Rachmawati, Emma., Linda, Onny., Fikri. Ipik M., Prita Dewi, Evindiyah, <sup>1</sup> University of Muhammadiyah Prof DR HAMKA (UHAMKA) Jakarta	324-327
THE MODEL OF GLUCOSE FLUCTUATION WITH DIABETES BASED ON MAPPING HbA1c AND MEAN AMPLITUDE OF GLUCOSE EXCURSION VALUE Lailis Syafa'ah <sup>1</sup> , Rasad Indra <sup>2</sup> , Budi Santoso <sup>3</sup> , Askandar Tjokro Prawiro <sup>4</sup> <sup>1,3</sup> Technique Faculty Electronic Department Muhammadiyah University Malang, <sup>2,4</sup> Medical Faculty Brawijaya University	328-331
THE EFFECT OF HIGH ENEMA TO DECREASE BLOOD UREA LEVEL OF CHRONIC	332-335

RENAL FAILURE PATIENTS OF PROF. DR. MARGONO SOEKARDJO PUBLIC HOSPITAL PURWOKERTO Made Suandika	
RELATIONSHIP BETWEEN HYPNOBIRTHING RELAXATION TECHNIQUES AND CHILDBIRTH DURATION OF STAGE 1 ON BPM SAYIDAH KEC. KALIWUNGU KAB. KENDAL Maria Ulfah Kurnia Dewi	336-338
TELEHEALTH IMPLEMENTATION USING AN ONLINE MEETING APPLICATION FOR THE REMOTE AREA HEALTH SERVICES Muchlas* and Rizky Nur Ardia Oktaviani** *Department of Electrical Engineering, Universitas Ahmad Dahlan, **Department of Public Health, Universitas Ahmad Dahlan	339-342
DEVELOPMENT OF SURV-TB (TUBERCULOSIS SURVEILLANCE WEBGIS) Noor Alis Setiyadi <sup>1</sup> , Sabarinah B. Prasetyo <sup>2</sup> <sup>1</sup> Prodi Kesehatan Masyarakat, Fakultas Ilmu Kesehatan, Universitas Muhammadiyah Surakarta, <sup>2</sup> Fakultas Kesehatan Masyarakat, Universitas Indonesia	343-346
STUDY OF POST-STROKE HYPERGLYCEMIA THERAPY ON STROKE INPATIENTS IN PKU MUHAMMADIYAH YOGYAKARTA HOSPITAL Nurul Maziyyah <sup>1)</sup> Sugiyanto <sup>2)</sup> Inayati <sup>3)</sup> <sup>1)</sup> Pharmacy Programme, UMY, <sup>2)</sup> Faculty of Pharmacy, UGM, <sup>3)</sup> PKU Muhammadiyah Yogyakarta Hospital	347-350
WEI CHI 14 MERIDIANS EXERCISE AND PATIENT AFFIRMACY AS THE EMOTIONAL THERAPY Sutarno*, Widyoningsih** *Sutarno: Graduate Nursing, Health Science School Al-Irsyad Al-Islamiyyah Cilacap	351-354
THE EFFICIENCY OF GARLIC AND CUCUMBER CONSUMPTION IN DECREASING THE BLOOD PRESSURE AMONG THE ELDERS WITH HYPERTENSION Priyo,Prita Oktafiyana, Faculty of Health Sciences, Magelang Muhammadiyah University	355-360
IS THERE A DIFFERENCE BETWEEN FISAL IN STANDARDIZED EXTRACT FROM PHYSALIS ANGULATA. L AND CONTROL ON PANCREATIC FUNCTION OF SPRAGUE DAWLEY RAT INDUCED BY STREPTOZOTOCIN-NICOTINAMIDE? Yeny Sulistyowati, Sri Kadarsih Soedjono, Mustofa, Budi Mulyono	361-366
PHENOMENOLOGY STUDY OF HELPLESSNESS ELDERLY EXPERIENCE WITH HYPERTENSION IN BOGOR CITY Abdul Wakhid, Achir Yani S. Hamid, and Yossie Susanti Eka Putri	367-372
PROFILE OF JOB SATISFACTION AND ITS EFFECT ON CARING BEHAVIOR OF HOSPITAL NURSES Jebul Suroso, Faculty of Health Science of Muhammadiyah University of Purwokerto	373-377

HOW TO INCREASE MILK PRODUCTION FROM MOTHER WITH INFANT LOW BIRTH WEIGHT (LBW) Umi Solikhah <sup>1</sup> , Indri Wisudawati Anggraeni <sup>2</sup> , Sodikin <sup>3</sup> <sup>1,3</sup> Faculty of Health Science University of Muhammadiyah Purwokerto, <sup>2</sup> Nurse	378-382
CORRELATION BETWEEN SOCIAL SUPPORT AND POSTPARTUM QUALITY OF LIFE Faizah Betty Rahayuningsih, Health <i>Science</i> Faculty, Universitas Muhammadiyah Surakarta	383-388
CORRELATION BETWEEN KEGEL EXERCISE WITH NEEDLE PERINEUM INJURY HEALING AT NORMAL POSTPARTUM WOMAN IN RB AFIATUN HASANAH BANDUNG Annisa Ridlayanti, STIKes Aisyiyah Bandung	389-392
THE CORRELATION BETWEEN SELF-CONFIDENCE AND DEPRESSION LEVEL OF TEENAGE ORPHANAGES IN PANTI ASUHAN YAYASAN SATU UMAT IN MAGELANG Peni Nurman, Sambodo Sriadi Pinilih, Priyo, Nursing Science Department of Health Science Faculty of Muhammadiyah University of Magelang	393-395
DETERMINATION AND VALIDATION METHOD OF TOTAL FLAVONOID CONTENT AND TOTAL PHENOLIC CONTENT OF ETHANOLIC EXTRACT OF MANGOSTEEN ( <i>Garcinia mangostana</i> L.) LEAVES AS NATURAL PRESERVATIVES CANDIDATE BY USING SPECTROPHOTOMETRIC METHOD Diniatik, Indri Hapsari, Milani Tiara, Ayu Meidyawati, Suhri Nurhidayat, Faculty of Pharmacy Muhammadiyah University of Purwokerto	396-405
FORMULATION AND ANTIOXIDANT ACTIVITY TEST OF LIPSTICK FROM MANGOSTEEN RIND ( <i>Garcinia mangostana</i> L.) METHANOL EXTRACT Gigih Aditya Pamungkas*, Nuryanti, Iskandar Sobri, Departement of Pharmacy FKIK Jenderal Soedirman University	406-411
THE ROLE OF MEDIA EXPOSURE AND HEALTH BELIEF ON BREAST SELF EXAMINATION Khamidah Achyar, <sup>1</sup> Anita D. Anwar, <sup>2</sup> H. Herry Garna <sup>2</sup> <sup>1</sup> University Muhammadiyah Purwokerto, <sup>2</sup> Padjadjaran University	412-415
PHENOMENOLOGY STUDY OF VARIOUS OBSTACLE EFFORTS TO ELIMINATE OF DENGUE HAEMORAGIC FEVER IN BANYUMAS DISTRICT Isna Hikmawati, Dedy Purwito	416-420
RELATIONSHIP BETWEEN ANTENATAL CARE SERVICES AND PERINATAL MORTALITY RISK FACTORS IN PUBLIC HEALTH CENTER OF PALEMBANG IN 2012 Rosmiarti, Enderiasari, Midwifery Diploma Degree Muhammadiyah Palembang	421-424
EFFECT OF MIND BODY COMPLEMENTARY THERAPIES: LISTENING TO PASSAGES OF ALQUR'AN AGAINST LOWERING BLOOD PRESSURE AT SOCIAL INSTITUTION OF TERATAI NURSING HOMES PALEMBANG 2013 Trilia, Nursing of Science Diploma Degree Muhammadiyah Palembang	425-429



EFFECT OF DHIKR THERAPY ON LABOR PAIN KALA 1 AT MATERNITY CLINIC BUDI INDAH IN PALEMBANG IN 2012 Maya Fadlilah and Mar'atun Ulaa, Nursing of Science Diploma Degree Muhammadiyah Palembang	430-436
ETHANOL EXTRACT OF BINAHONG LEAVES EFFECT ( <i>Anredera cordifolia</i> (Ten.) Steen) ON HEMATOLOGYCAL CHANGES IN FEMALE WISTAR RATS Silma Kaffah <sup>1</sup> , Fitri Kurniwati <sup>1</sup> , Anjar Mahardian Kusuma <sup>1</sup> , Asmiyenti Djaliasrin Djalil <sup>2</sup> <sup>1</sup> Laboratory of Pharmacology-Toxicology, Faculty of Pharmacy, University of Muhammadiyah Purwokerto, <sup>2</sup> Laboratory of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Muhammadiyah Purwokerto	437-439
THE COMPARISON OF FREE RADICALS SCAVENGING ABILITIES BETWEEN ETHANOL EXTRACTS OF PURWOCENG ( <i>Pimpinella pruatjan</i> Molk.) HERBS AND LEAVES Balqis Hisyam Saleh Basleman, Wiranti Sri Rahayu, Retno Wahyuningrum, Pharmacy Faculty of Muhammadiyah University of Purwokerto	440-446
DIFFERENCES INFLUENCE PLYOMETRIC EXERCISE WITH NEUROMUSCULAR ELECTRICAL STIMULATION (NMES) TO INCREASE THE ABILITY OF VERTICAL JUMP IN BASKETBALL PLAYER STIKES MUHAMMADIYAH PALEMBANG Putri Edrivania, Usman, Ika Guslanda Bustam, Program Study DIII Physical Therapy, STIKes Muhammadiyah Palembang	447-454
THE CORELATION BETWEEN KNOWLEDGE OF ANEMIA WITH ANEMIA INCIDENT IN PREGNANTS Beti Rahayu Utami, Wilis Dwi Pangesti	455-460
THE IDENTIFICATION BACTERIA <i>Streptococcus Pneumoniaee</i> IN THE AIR ROOM PAUD IN SEBERANG ULU 1 PALEMBANG Heri Shatriadi, Zairinayati, Hoetary Tirta Amalia, Environmental Health of Science Diploma Degree Muhammadiyah Palembang	461-464
THE DIFFERENCE ACCURACY APPRAISAL WEIGHT EMBRYOLOGY IN RISANTO METHOD AND USG WITH WEIGHT BABIES WERE BORN IN A HEALTH CLINIC TEGALREJO 2009 Marlin, Riska, Science Diploma Degree Muhammadiyah Palembang	465-473
THE INFLUENCE OF EARLY BREASTFEEDING INITIATION TO THE DURATION OF LABOR THIRD PERIOD IN MATERNITY MOTHER AT AL-JARIYAH MATERNITY HOSPITAL PALEMBANG IN 2013 R.A. Aminah Maya, Citra Purwanti, Prodi DIII Kebidanan STIKes Muhammadiyah Palembang	474-478
CYTOTOXIC ACTIVITY TEST OF EXTRACT AND FRACTION OF GALANGAL ( <i>Alpinia galanga</i> ) ON HeLa CELLS BY INVITRO Puji Setya Rini, Irsan Saleh, Theodorus, Salni, Stikes Muhammadiyah Palembang	479-487
TOXIC EFFECTS OF FORMALDEHYDE KIDNEY Mice ( <i>Mus musculus</i> L) SWISS WEBSTER MALE Ra. Hoetary Tirta Amallia, Sri Nita, Theodorus Program Studi D III Kesehatan Lingkungan, STIKES Muhammadiyah Palembang, Indonesia	488-493

## SCIENCE AND AGRICULTURE

FARMERS BEHAVIOR TOWARD RISKS OF POTATO FARMING FOR GRANOLA AND ATLANTIC VARIETIES IN BANJARNEGARA REGENCY Pujiharto, Agricultural Faculty University of Muhammadiyah Purwokerto	494-497
THE EFFECTIVENESS OF CLOVE OIL TO CONTROL SOYBEAN RUST DISEASE Sumartini and Eriyanto Yusnawan, Indonesian Legumes and Tuber Crops Research Institute	498-500
VEGETATIVE AND GENERATIVE PERFORMANCES OF THREE SOYBEAN VARIETIES IN FIVE LEVELS OF COLCHICINE DOSAGES AND SEED COAT PEELING TREATMENTS Sutrisno and Heru Kuswantoro, Indonesian Legume and Tuber Crops Research Institute, Indonesian Agency for Agriculture Research and Development	501-504
SIMPLE PARTISIPATORY GIS FOR LAHAR HAZARD IDENTIFICATION IN CIMUJA RIVER SUBANG DISTRICT Rendi Firdian I, Aditya Saputra, and Priyono, Geography Faculty Universitas Muhammadiyah Surakarta	505-508
THE ANALYSIS OF KALIUM -40 RADIONUCLIDE POLLUTION AT SEDIMENT, SEA WATER AND SHRIMP ( <i>Penaeus Merquiensis</i> ) IN CILACAP COASTAL OCEAN Wahikun, Akademi Maritim Nusantara	509-512
THE EFFECT OF RHIZOBIUM INOCULATION ON TOTAL FLAVONOID, PHENOLIC CONTENTS, AND ANTIOXIDANT ACTIVITY OF SOYBEAN SEEDS Eriyanto Yusnawan, Indonesian Legumes and Tuber Crops Research Institute	513-517
SCREENING OF MUNGBEAN MUTANT GENOTYPES RESISTANT TO POWDERY MILDEW ( <i>Erysiphe polygoni</i> ) AND LEAF SPOT DISEASE ( <i>Cercospora canescens</i> ) Sumartini <sup>1)</sup> , Yuliastuti <sup>2)</sup> , Eriyanto Yusnawan <sup>1)</sup> <sup>1)</sup> Indonesian Legumes and Tuber Crops Research Institute, <sup>2)</sup> Indonesian Atomic Institute	518-521
FUNCTION OF AGRICULTURE TECHNOLOGY ENVIRONMENT IN CARING FOR FOOD SECURITY SUPPORT IN SUBDISTRICT BELIK OF PEMALANG REGENCY Watemin and Sulistyani Budiningsih, Agriculture Faculty of Muhammadiyah Purwokerto University	522-525
EFFECT OF RICE BRAN AND ANORGANIC FERTILIZER DOSAGES ON YIELD OF WHITE OYSTER MUSHROOM ( <i>Pleurotus ostreatus</i> ) Agus Mulyadi Purnawanto, Oetami Dwi Hajoeningtjas, Pujiati Utami, Faculty of Agriculture, University of Muhammadiyah Purwokerto	526-533
UTILIZATION OF WASTE OIL PALM AS A TOTAL MIXED RATION SILAGE WITH LOCAL RESOURCES BASED TO ACHIEVED FOOD SECURITY IN AN ANIMAL PROTEIN SOURCES Agung Irawan, Mohammad Sholikin, Department of Animal Science, University of Muhammadiyah Malang	534-537
CALCULATION PENSION PLAN USING BENEFIT PRORATE METHOD (A Case Study of State Lecturers and Employees at Muhammadiyah Cirebon University) Setyo Wira Rizki and Rifqi Hidayat	538-542

<p>PROFILE OF MICROENTERPRISES CREATIVE SOUVENIR PROCESSED COCONUT WASTE MANAGED BY POOR ARTISANS FARMERS IN RURAL</p> <p>Dumasari<sup>1</sup>, Tri Septin Muji Rahayu<sup>2</sup>, Sulistyani Budiningsih<sup>3</sup></p> <p><sup>1,3</sup>Lecturer of Agribusiness Program Study, Faculty of Agriculture, University of Muhammadiyah Purwokerto, <sup>2</sup>Lecturer of management Program Study, Faculty of Economic, University of Muhammadiyah Purwokerto</p>	543-547
<p>DEVELOPMENT OF FUSARIUM DISEASE CONTROL TECHNOLOGY WITH BIOLOGICAL AGENT IN MAS CULTIVAR BANANA SEEDLINGS RESULT <i>IN VITRO</i> CULTURES</p> <p>Anis Shofiyani and Gayuh Prasetyobudi</p>	548-555
<p>SOCIAL ECONOMIC</p>	
<p>SERVICES CAPACITY OF ISLAMIC FINANCIAL SERVICES COOPERATIVE IN THE DEVELOPMENT OF SMALL AND MEDIUM ENTERPRISES (SMEs) IN PURWOREJO CENTRAL JAVA INDONESIA (Analysis of Services Quality Effect to Loyalty with Satisfaction as an intervening variable in Business Partner of Islamic Financial Services Cooperative In District Purworejo)</p> <p>Agus Fitri Yanto, Danis Imam Bachtiar and Agus Dwi Atmoko, Polytechnic Sawunggalih Aji - Purworejo</p>	556-562
<p>THE ROLE OF SMALL AND MEDIUM ENTERPRISES (SMEs) TO COMMUNITY BUSINESS DEVELOPMENT IN INDONESIA (A Study of Productive Economic Activities in Kalimantan)</p> <p>R. Deni Muhammad Danial<sup>1</sup> and Heinrich Gultom<sup>2</sup></p> <p><sup>1</sup>Student of Doctoral Program of Business Administration UNPAD, Lecturer of Business Administration, Muhammadiyah University of Sukabumi (UMMI), <sup>2</sup>PNPM Support Facility-World Bank</p>	563-566
<p>CORRELATION BETWEEN INTENSITY OF PLAYING ONLINE GAME AND EMOTIONAL INTELLIGENCE</p> <p>Ulfi Kholidiyah dan Susatyo Yuwono, Psychology Department of Muhammadiyah University of Surakarta</p>	567-571
<p>GAIN AND LOSS OF COMPARATIVE ADVANTAGE AMONG ASEAN-6</p> <p>Yuli Utami, International Program for Islamic Economics and Finance, Department of Economics-University Muhammadiyah Yogyakarta</p>	572-581
<p>GAMES ONLINE INFLUENCE AT THE CAFE ON LANGUAGE DEVELOPMENT IN CHILDREN AT KELURAHAN CEMPAKA PUTIH, CIPUTAT TIMUR, TANGERANG SELATAN</p> <p>Ati Kusmawati, Muhammadiyah University of Jakarta</p>	582-585
<p>ANALYSIS OF EFFECT OF PRICE, LOCATION AND SERVICES TO INCREASE SALES VOLUME</p> <p>Henny Dwijayani, Departement of Management, Faculty Economics of Universitas Darul Ulum, Jombang</p>	586-588

STUDY OF SELF-EFFICACY IN GRADUATE UNEMPLOYMENT Suwarti and Ugung Dwi Ario Wibowo, Psychology Faculty of University of Muhammadiyah Purwokerto	589-593
EXISTENCE OF RURAL COMMUNITY IN THE DISSEMINATION OF AQUAPONIC TECHNOLOGY AT AGROTURISM VILLAGE Imam Santosa <sup>1</sup> , Muslihudin <sup>2</sup> , Taufik Budhi Pramono <sup>3</sup> <sup>1,2</sup> Sociology Study Program, Faculty of Social and Political Sciences, Jenderal Soedirman University, Purwokerto, <sup>3</sup> Lecturer of Fishery Study Program, Faculty of Science and Engineering, Jenderal Soedirman University Purwokerto	594-599
THE ANALYSIS OF RISK AND RETURN ON THE PROFIT-LOSS SHARING PRODUCTS IN THE INDONESIAN ISLAMIC BANKING INSTITUTION Yohani <sup>1</sup> , Achmad Tohirin <sup>2</sup> , Haryadi <sup>3</sup> , Sobrotul Imtikhanah <sup>4</sup> <sup>1,4</sup> Lecturer at the Department of Accounting, Muhammadiyah College of Economics (STIE) of Pekalongan, <sup>2</sup> Lecturer of Islamic Finance & Economics, Post Graduate Program, Faculty of Economics, Universitas Islam Indonesia, Yogyakarta, <sup>3</sup> Lecturer at the Department of Management, Faculty of Economics, Universitas Jenderal Soedirman (UNSOED), Purwokerto	500-606

## THE IMPACT OF MULTI MEDIA TECHNOLOGY TO ENGLISH TEACHING

**Jusmin H.J Wahid**  
Universitas Ahmad Dahlan

### **Abstract**

*In globalization era, every student must be able to operate multimedia technology as a method to help students in learning process and influential to communication and culture. Generally, when people talk about multimedia or rich media, they are talking about the graphics and displays online and the ways users can interact with them, clicking to enter new sections or produce different types of audio effects.*

*Multimedia in English teaching very big influence in communication and culture, to join conversations with streaming audio, video, and chat functions that allow for digital meetings. Employees can train together as groups for more complex material and students can converse with teachers and other classes around the world.*

*Multimedia methods of teaching in both school and work settings are the increase in available channels for teaching. Some students learn better through visuals, some students learn better by listening, and some learn by working through material on their own.*

**Keywords:** *Multimedia technology, English teaching*

### **INTRODUCTION**

#### **1. Multimedia**

Multimedia technology is a combination of traditional media forms that are present in online formats. The simplest type of multimedia object is a video that plays with accompanying sound, but multimedia projects go far beyond this. Generally, when people talk about multimedia or rich media, they are talking about the graphics and displays online and the ways users can interact with them, clicking to enter new sections or produce different types of audio effects.

Multimedia technology is exerting an enduring influence 'like a North Star' on almost every facet of life across the world today (Kluver, 2000:1). The power of multimedia technologies continues to reshape and re-define the nature and practice of politics, culture, commerce, religion and education. Specifically in the developing world, multimedia technologies are associated with the emergence of a new knowledge society, largely

ascribed to a process called *information*, which is fashioned in the backdrop of today's globalization. The concept of information refers to information technologies such as the World Wide Web (WWW), which have transformed society. According to Hofstede G. 1997, in Wang 1994:5 describes information as a process of change due to information communication technology (ICT) to such an extent that they become the dominant forces in commanding societal transformations and popularity of information production and distribution. In his ground-breaking thesis, Masuda (1982:29) argues that societies have to re-align themselves in the light of the tremendous significance to the forces of the new technological innovations that are now part and parcel of the 'new order.

Media is a means of transmitting information or the various forms, devices, and system that make up mass communications considered as a whole, including newspaper, magazines, radio stations, television channels, and Web sites. Before alphabetic writing, the media for communicating information were oral-auditory and pictographic. Writing facilitated the creation and storage of printed texts. Later print technology made such texts available to masses of people (Danesi, 2009:192).

**Okolo and Ferretti (1998)** Showed that student composition representing ideas simultaneously through text and audio, video and sound increased the likelihood that students will acquire an understanding of complex information. It is a reasonable conjecture that using an even wider range of media will extend this effect. The same study also noted that students with a wide range of abilities "readily mastered these tools and were highly motivated by the opportunity to augment their writing with other media." That is, this increased variety of expression enhanced attitudes as well.

There are several categories are important to emerge out of the qualitative analysis of the data which is included extensive:

- a. Videotapes
- b. Interviews
- c. Observations, and

d. Student-created materials<sup>1</sup>.

There are three methods of using multimedia aspect of online teaching as:

**2. Multiple Learning Channels**

One of the key benefits to multimedia methods of teaching in both school and work settings is the increase in available channels for teaching. Some students learn better through visuals, some students learn better by listening, and some learn by working through material on their own. Multimedia aspects of online teaching allow teachers and trainers to use all three methods, reaching students more easily no matter their learning type<sup>2</sup>.

**3. Continuous Resources**

Online multimedia centers are very easy to access, and they can easily be updated to keep them current, unlike hardcopy books. As a result, online course information tends to be useful far longer than more traditional types of teaching materials. Students and employees can refer back to the same resources of data they used when learning if they have any questions. Teachers and managers must maintain such centers of knowledge in order for them to be effective over the long term<sup>3</sup>.

**4. The Advantages of implementing multimedia in the classroom**

a. The Advantages of Multimedia

In using multimedia in teaching English has a lot of advantages they are:

- 1) **Motivation.** This is important as we have learned that we must first engage the attention of our students before they are ready to learn. And students find the use of multimedia very motivating and entertaining.
- 2) **Learning styles addressed.** Multimedia allows teachers to address various learning styles in the classroom. Students can see, hear, and imagine what things feel like as multimedia is used to bring a subject to life.
- 3) **Access to limitless resources for teaching and learning.** Teachers are no longer limited to textbooks as vast amounts of knowledge and teaching ideas may be explored.

<sup>1</sup>[http://www.athensacademy.org/instruct/media\\_tech/reeves0.htm](http://www.athensacademy.org/instruct/media_tech/reeves0.htm)  
1

<sup>2</sup> (<http://www.ceap.wcu.edu/houghton/MM/RationaleMM.html>)

<sup>3</sup>[ihashimi.aurasolution.com/advantages\\_and\\_di](http://ihashimi.aurasolution.com/advantages_and_di)  
Multimedia centers are very easy to access, and they can easily be updated to keep them current, unlike hardcopy books. As a result, online course information tends to be useful far longer than more traditional types of teaching materials.

4) **Student centered learning.** Students will show accountability for learning when collaborative activities or project based learning is implemented through technology.

5) **Students relate to visual interactions.** Especially if there is a game like atmosphere to the presentation. This method helps the students become more engaged in the project.

6) **Classroom management.** Class web sites can provide "one stop shopping." Handouts, assignments, rubrics can all be accessible to students whenever they may need further information. This is also handy for students to complete their work whenever it is convenient for them.

7) **Addresses multiple learning styles.** Material is presented using various learning styles simultaneously. For example auditory and visual approaches.

8) **Helps to prepare the teacher.** A quality multimedia presentation makes sure that preparation has been done a head of time so that class instruction will be organized, include a variety of learning types, and be relevant<sup>4</sup>.

Another resources come from IBM (Hall & Baumgartner, 1991, p. 260) suggested many advantages (according to their view) of multimedia:

- 1) Increases learning effectiveness.
- 2) Offers significant potential in improving personal communications, education and training efforts.
- 3) Tailors information to the individual.
- 4) Provides high-quality video images & audio.
- 5) Frees the teacher from routine tasks.
- 6) Gathers information about the study results of the student<sup>5</sup>:

<sup>4</sup>One reason to implement multimedia into the classroom is because it is engaging. Multimedia allows us to make our lessons entertaining; therefore grabbing the attention of our students. The second reason is that it allows us to provide differentiated instruction. Having different ways to present information to our students allows teachers to meet the needs of all students. The third reason is that multimedia is a great way to make sure our lessons are organized. There are many tools that we can use to help organize our presentation; therefore making it easier to understand. The fourth reason is that we are exposing our students to the real world. Our students are going to be required to use multimedia in their jobs one day and by exposing them at an early age we are preparing them for the future. The last reason to use multimedia is that is can enhance concepts that are not as interesting as others. There are many ways that the web can turn a not so interesting topic into something the students are willing to learn.

<sup>5</sup>[bloggingonthebay.edublogs.org/.../advantages](http://bloggingonthebay.edublogs.org/.../advantages).



- b. The Disadvantages of multimedia:
- 1) Expensive
  - 2) Not always easy to configure
  - 3) Requires special hardware
  - 4) Not always compatible

### THE DEFINITION OF TECHNOLOGY

Technology is utilized for the up liften of modern styles; it satisfies both visual and auditory senses of the students. With the spread and development of English around the world, English has been learned and used by more and more speakers. According to David Graddol 'it is the language at the leading edge of scientific and technological development, new thinking in economies and management, new literatures and entertainment genre.

Technology is the idea that technology shapes the course of human evolution. Many historians of science argue that technology has not only become an essential condition of advanced, industrial civilization, but also that the rate of technological change has developed its own momentum. Innovations appear at a rate that increases geometrically, unhindered by geographical limits or social systems, these innovations tend to transform traditional cultural systems, frequently with unexpected social consequences. Some social critics therefore define technology as both a creative and a destructive process (Danesi, 2009:285).

According to the Lexicon Webster Dictionary Volume II (1977:1008) technology is the branch of knowledge that deals with the industrial arts and sciences; utilization of such knowledge the knowledge and means used to produce the material necessities of a society.

### THE USE OF TECHNOLOGY IN TEACHING ENGLISH

As the use of English has increased in popularity so has the need for qualified teachers to instruct students in the language. It is true that there are teachers who use 'cutting edge' technology, but the majority of teachers still teach in the traditional manner. None of these traditional manners are bad or damaging the students. In fact, till date they are proving to be useful also. However, there are many more opportunities for students to gain confidence practice and extend themselves, especially for ESL students who learn the language for more than just fun. For them to keep pace with ELT and gain more confidence they have to stride into the world of multimedia technology.

### ANALYSIS ON NECESSITY OF APPLICATION OF MULTIMEDIA TECHNOLOGY IN TEACHING ENGLISH

#### 1. To Cultivate Students' Interest in Study

Nowadays, the stereotyped traditional teaching methods and environment are unpopular while multimedia technology featuring audio, visual animation effects naturally and humanely makes us more access to information besides, with such characteristics as abundant-information and crossing time and space, multimedia technology offers a sense of reality and functions very well, which greatly cultivates students' interest and motivation in study and their involvement in class activities.

#### 2. To Promote Students' Communication Capacity

Traditional teaching has hampered students' capacity to comprehend certain language and also understanding to structure, meaning and function of the language, and makes the students passive recipients of knowledge. So it is hard to achieve the target of communication. With teachers' instructions leading students' thought patterns and motivating students' emotions, the multimedia technology seeks integration of teaching and learning and provides the students greater incentives. The PPT courseware activate students' thinking; the visual and vivid courseware rand help them to transforms English learning into capacity cultivation. And such in-class activities as group discussion, subject discussion, and debates can also offer more opportunities for communication among students and between teachers and students. So multimedia technology teaching has uniquely inspired students' positive thinking and communication skills in social Practice.

#### 3. To Improve Teaching Effect

Multimedia teachings enrich teaching content and make the best of class time and break the "teacher centered" teaching pattern and fundamentally improve class efficiency. Due to large classes it is difficult for the students to have speaking communication. The utilization of multimedia sound lab materializes the individualized and co-operative teaching. The traditional teaching model mainly emphasized on teachers' instruction, and the information provided is limited due to traditional classes. On the contrary, multimedia

Technology goes beyond time and space, creates more vivid, visual, authentic environment for English learning, stimulates students' initiatives and economizes class time meanwhile increases class information.

#### **4. To Improve Interaction between Teacher and Student**

Multimedia teaching stresses the role of students, and enhances the importance of "interaction" between teachers and students. A major feature of multimedia teaching is to train and improve students' ability to listen and speak, and to develop their communicative competence, during this process, the teacher's role as a facilitator is particularly prominent. Using multimedia in context creation creates a good platform for the exchange between teachers and students, while at the same time providing a language environment that improves on the traditional classroom teaching model. In this way, teachers in the classroom no longer blindly input information and force students to receive it in a passive way blindly input information and force students to receive it in a passive way.

#### **5. Creates a Context for Language teaching**

Multimedia teaching creates a context for language teaching. This method makes the class lively and interesting, as well as optimizing the organization of the class. Multimedia has its own features such as visibility and liveliness. During the process of multimedia English teaching, sounds and pictures can be set together, which enhances the initiative of both teachers and students. When using multimedia software, teachers can use pictures and images to enrich the content of classes, and also imagine different contexts in the process of producing teaching courseware. Students in the class can use multimedia to understand the class in a clear way. Through the whole interactive process, it is apparent that using multimedia in ELT is effective in nurturing students' interest in learning English, as well as enhancing teachers' interest in English teaching. As Zhang (2006:11.1) points out through Multimedia and network technology we can offer students not only rich, sources of authentic learning materials, but also an attractive and a friendly interface, vivid pictures and pleasant sounds, which to a large extent overcomes the lack of authentic language environment and arouses students' interest in learning English.

#### **THE DEFINITION OF ENGLISH TEACHING**

Teaching is a social process, to define it is very difficult, because the teaching influenced by the political and social backgrounds of the country. Hence, just try for it, after reading all the definitions. There are so many educationists, complimented their definitions about teaching. Here are some, to keep in mind. According to Gage, "Teaching is a form of interpersonal influence

aimed at changing the behavior potential of another person. "Edmund Amidon defined it as- "Teaching is an interactive process, primarily involving classroom talk which takes place between teacher and pupil and occurs during certain definable activity."

Brubacher, "Teaching is an arrangement and manipulation of a situation in which an individual will seek to overcome and from which he will learn in the course of doing so. Skinner- "Teaching is the arrangement of contingencies of reinforcement. "Ryans-"Teaching is concerned with the activities which are concerned with the guidance or direction of the learning of others. "From these I want to make one definition, as my view. Me," Teaching is a process that improves the student's seeking level more easily and it might be overcome any situation as an easy way." Make definition our own after reading it.

Another definition supposed by Sukdevsingh Teaching can be defined as interaction between the teacher and the taught as far as it is related to imparting of the knowledge to the students, to cover almost every aspect of education which the students are expected to learn from a teacher and which the teacher will teach them using all the teaching techniques and aids available to teach. This includes motivation, encouragement and character building of the students. A good teacher must understand each and every trait of each of his students to deal them accordingly. In a nut shell we can say that teaching is to train the students in a way that they can be useful citizens of a nation. People may try to define teaching in their own way but whatever the definition is given it must include the training in various subjects of study as well as the building of the personality of the students. One of the techniques to improving the students' meets the academic needs and helps them developing English language skills is providing multimedia during the process of teaching and learning in the classroom. Multimedia classroom provide the students chances for interacting with diverse texts that give them a solid background in the tasks and content of mainstream college courses.

The writing aims to find out some advantages of the use of multimedia in the classroom. Also, the involvement of technology in the classroom cannot deny giving positive point to improving the quality of teaching and giving more various techniques in teaching a foreign language. The research uses a qualitative method giving a deeply description using multimedia in the classroom. The difference between a traditional classroom and multimedia classroom has been drawn in this writing. The writing shows that there are some advantages in

teaching English using multimedia as a technique in teaching process in the classroom. Through the media the teacher could give more opportunity to students to express their opinions and enjoy during the course. The highly presence and motivation also bring positive aspects to students so that they can improve their skills.

In Indonesia, English is taught in schools since the students go to Junior high schools. However, many of them do not know how to speak and write English for some reasons. Some people from educational field said that the curriculum need to be changed, including the purpose of teaching them English, the textbook, and the methods. To meet the students' academic needs and help them develop strong English language skills, there are a number of ways need to be applied. One of the techniques to improving the students is using multimedia in the process of teaching and learning in the classrooms. Multimedia use in classroom will provide opportunity for interacting with diverse texts that give students a solid background in the tasks and content of mainstream college courses. Furthermore, because educational technology is expected to become an integral part of the curriculum, EFL students must become proficient in accessing and using electronic resources<sup>6</sup>.

## CONCLUSION

Through the interaction with multimedia, the students become increasingly familiar with academic vocabulary and language structure. Connecting with the Internet will make the benefit of increased student motivation. Students are eager to begin class and often arrive early at the computer lab, logging on the Internet and beginning research on their own. They also often stay after class to continue working on the Internet. Overall, students develop greater confidence in their ability to use English because they need to interact with the Internet through reading and writing. Using multimedia provides the students to gather information through media that encourages their imaginations, interests. Also it using this technology combined with the sense of teaching will create a successful teaching method<sup>7</sup>.

Multimedia to understand the class in a clear way. Through the whole interactive process, it is apparent that using multimedia in ELT is effective

in nurturing students' interest in learning English, as well as enhancing teachers' interest in English teaching.

## References

- Danesi, Marcel. (2009). *Dictionary of Media and Communications*. New York: M.E. Sharpe, inc.
- Hofstede, G. (1997). *Cultures and Organizations: Software of the mind*. New York: McGraw Hill.
- Pei, Mario. (1977). *The Lexicon Webster Dictionary: Volume Two Oyster Bed To Zymurgy Supplements*. Columbia University: Lexicon.
- Riley, Philip. (2007). *Language, Culture and Identity*. New York: continuum.
- <http://paksira.wordpress.com/2009/05/22/teaching-english-using-multimedia/>
- <http://www.ipedr.com/vol33/030-ICLMC2012-L10042.pdf>

<sup>6</sup>[www.phy.ilstu.edu/.../teachlearn/teaching\\_lear](http://www.phy.ilstu.edu/.../teachlearn/teaching_lear).

<sup>7</sup><http://paksira.wordpress.com/2009/05/22/teaching-english-using-multimedia/>

*Using multimedia provides the students to gather information through media that encourages their imaginations, interests. Also it using this technology combined with the sense of teaching will create a successful teaching method*

## THERE IS AN ELEPHANT IN MY ROOM: CHALLENGES IN TEACHING MULTIPLE LEVELS OF REPRESENTATION FOR CHEMISTRY PRESERVICE TEACHERS

**Muhamad Imaduddin**

Study Program of Chemistry Education, Mathematic and Natural Science Faculty,  
Muhammadiyah Semarang University  
Kedungmundu Raya 18, Semarang 50273, Telp. (024) 76740291  
Email: muhamad.imaduddin89@gmail.com

### **Abstract**

*The ability of students to solve mathematical problems is often used as standard of mastery of chemistry concepts. Contrarily, the understanding of students on chemistry could be seen through their ability to connect multiple level of representations, namely macroscopic, submicroscopic, and symbolic level. The aim of study was to explore difficulties of the learners in understanding the levels of chemical representation. Tested subjects were 31 students of chemical education at LPTK (an Institute for Preservice Teachers). Firstly, mapping of misconceptions was conducted to determine the condition of preservice teachers' mastery of concepts. Worksheets specifically were designed for classroom discussion activity on acid-base concepts; solution equilibrium; solubility. Data were collected through tests of concept mastery and non-test ie interviews. One group pretest-posttest design was applied in this study. % N-g in students' mastery of concepts was analyzed. Results showed that % N-gain at "medium" level category (0,3). It was only 5 preservice teachers (from 31 preservice teachers) showed the ability to connect the macro-submicro-symbolic level. The difficulties of teaching chemistry due to the barrier in the processing of information within working memory space. The mastery of symbolic level was an important source of this barrier.*

**Keywords:** Multiple level of representations, the macro-submicro-symbolic level; preservice chemistry teachers; working memory space

### **BACKGROUND**

Science, especially chemistry, often is considered by teachers, researchers, and educators as a difficult subject for students. There are various reasons for this. There are several main reasons why chemistry is difficult. One of reasons is that the chemistry topics are very abstract. Another

reason is the presence of words from everyday language used in chemistry but have different meanings (Bergquist and Heikkinen, 1990). The third reason is the lack of formal operational development and visualization capabilities owned by "students" (Gabel, Samuel, & Hunn, 1987).

Some other literature also indicates the difficulties that may occur in the study of chemistry (Sirhan, 2007). Difficulties make students not mastering the material of chemistry entirely. One important reason for students' difficulties in understanding the chemistry is closely related to the multiple levels of representation used in describing and explaining chemical phenomena (Johnstone, 2000a, 2000b; Tasker & Dalton, 2006; Eilks, *et.al*, 2007, Chandrasegaran *et.al.*, 2007). The understanding of students on chemistry could be seen through their ability to connect multiple level of representations, namely macroscopic, submicroscopic, and symbolic level (Johnston, 2000a, 200b; Treagust & Chandrasegaran, 2009;

Talanquer, 2011). Wu, *et.al.* (2000); Devetak, *et.al* (2004); Tasker & Dalton (2006); Chandrasegaran *et.al.* (2007); and Chittleborough & Treagust (2007). Wu, *et.al.* (2000); Devetak, *et.al* (2004); Tasker & Dalton (2006); Chandrasegaran *et.al.* (2007); and Chittle borough & Treagust (2007) explained that (1) the macroscopic representations describe the essential nature of real phenomena which can be seen through the daily experiences; (2) the submicroscopic representations (or molecular) provide an explanation for the particulate level. This level is composed of real and particulate levels used to describe the movements of electrons, molecules, particles and atoms. The material is described as the arrangement of atoms, molecules, or ions; (3) the symbolic representations (or iconic) involve the use of chemical symbols, formulas and equations, the molecular structure drawing, diagram, pictorial representations (images), algebra,

and computational forms of submicroscopic representations.

Various research findings have expressed learner's difficulties which may occur in the study of chemistry concept related to the concept of acids and bases (Drechsler & Schmidt, 2005; Çetingül & Geban, 2005; Sheppard, 2006; Chaiphapha et al, 2011; Metin, 2011; Muchtar & Harizal, 2012) as well as the concept of pH (Watters & Watters, 2006). The materials which are still associated with chemical equilibrium in acid-base solutions, related to chemistry of the solution (Calik et al., 2005; Morgil et al., 2009) and the solubility and solubility products (Krause, S. & Tasooji, A., 2007), still often had misconceptions. Topics of acids and bases is closely related to basic chemistry concepts that require a thorough understanding (Sheppard, 2006). However, learners often only gain knowledge about the concept of acid-base through memorization without understanding the concept (Lin et al., 2004).

Basically, chemistry concepts will be easily revealed by understanding the microscopic representation (Smith & Metz, 1996: 233). Difficulties of learners on chemistry concepts may be due to lack of development of submicroscopic representation through proper visualization on learning. The assumption is reinforced by the fact and review of the literature, that teachers generally limit the level of macroscopic and symbolic representations in teaching learning process, while the relation with the level of submicroscopic was ignored. The students are expected to understand themselves by looking at the pictures in the book without direction from the teacher. In addition, students are also more in learning mathematical problem solving without interpret what is meant about. The ability of students to solve mathematical problems is often used as standard of mastery of chemistry concepts.

The effectiveness of teaching chemistry in school is influenced also by the ability of teachers to understand and get the hang of the concept to students, it is deemed relevant to improve the competence of preservice teachers to mastery chemistry concepts in macroscopic, submicroscopic, and symbolic level. Nevertheless, the challenges might come up considering pre-conceptions that were previously owned by preservice teachers. Therefore, this study seeks to explore how learners' difficulties in understanding the levels of chemical representation.

## METHODOLOGY

Qualitative data were collected through a case study based on interviews with 9 informants. Interview guidelines for misconceptions (IGM) were used in interviews as an instrument to map and identify the ability of learners in linking levels of chemical representation. Quantitative data were obtained through test of concept mastery (TCM). TCM is a type of criterion-referenced test, tests used to measure students' mastery or ability by certain criteria predefined by the evaluator without comparing with the other students' mastery or ability (Sukardi, 2009). The tests were essay test items used to examine the concept mastery. Concepts, associating with acid-base theory, acid-base equilibrium (determination of pH and acid-base titration), buffer solution and hydrolysis concepts, as well as the mechanism of solubility and solubility product, are analyzed and tested through the IGM and TCM. TCM was tested as a pre-test and post-test through a one-group pretest-posttest design. Tested subjects were 31 students of chemical education at LPTK (an Institute for Preservice Teachers) in Semarang City, Central Java. Furthermore, % N-g of concept mastery was analyzed to determine the level of improvement that occurred. This test was used to analyze the criteria for the achievement before and after learning (adapted from Hake, 1998: 65).

$$\langle g \rangle = \frac{\text{Post Test Score} - \text{Pre Test Score}}{\text{Maximum Score} - \text{Pre Test Score}}$$

By criteria of N-Gain level achievement:

$$\begin{aligned} 0,00 \leq \langle g \rangle < 0,30 &= \text{low} \\ 0,30 \leq \langle g \rangle < 0,70 &= \text{medium} \\ 0,70 \leq \langle g \rangle < 1,00 &= \text{high} \end{aligned}$$

Data of the total score were tested for normality with the Kolmogorov-Smirnov test using SPSS (Statistical Package for Social Science). If the results of the test data showed a normal distribution, the significance of differences was demonstrated before and after learning through Paired Samples t-test (Cohen et al., 2007). If the data are not normally distributed, the test used Wilcoxon Signed Ranks Test (Cohen et al., 2007). Categorization of learners refers modified criteria of Abraham et. al. (1992) in Table 1.

Table 1. Categorization of Students' Concept Mastery

Degree of Understanding	Scoring criteria	Category of concept mastery	Grade Score
Sound understanding	Responses that include all components of the validated response	<b>Mastering Concepts (MC)</b>	<b>5</b>
Partial understanding	Responses that include at least one of the components of the validated response, but not all the components		<b>4</b>
Partial understanding with specific misconception	Responses that show understanding of the concept but also make statements which demonstrate a misunderstanding	<b>Mastering Most of Concepts (MMC)</b>	<b>3</b>
Specific misconception	Responses that include illogical or incorrect information	<b>Mastering Concepts Slightly (MCS)</b>	<b>2</b>
Unspecific misconception	Unclear responses		
No understanding	Repeats question Irrelevant or unclear response	<b>Amateur In The Concept (AIC)</b>	<b>1</b>
No response	Blank I don't know I don't understand		<b>0</b>

## RESULTS AND DISCUSSION

### The Mapping of Students' Misconception

In this study, mastery of concepts was based on the ability of learners to connect the levels of chemical representation, macroscopic, submicroscopic, and symbolic level. Firstly, mapping and identifying the ability of learners in linking levels of chemical representation were conducted through Interview guidelines for misconceptions (IGM). Interview results were

analyzed and mapped to the table of misconception frame (Table 2.) and associated with studies that have been there. Misconceptions findings in this study may be relevant to the findings of previous research there.

Based on the interview, it can indirectly obtain information about how the ability of learners in linking levels of chemical representation. Patterns obtained can be seen in Figure 1.

Table 2. The Mapping of Students' Misconception

Misconceptions in Students	Dimension of Representation Level	Relevant Findings
Not familiar with the theories of Bronsted-Lowry acid-base and Lewis acid-base especially.	Mac → Sym	Muchtar & Harizal (2012)
Acid solution is definitely conduct electricity whereas an alkaline solution does not conduct electricity.	Mac → Mic	Çetingül & Geban (2005)
CH <sub>3</sub> COOH as a base because of the OH <sup>-</sup> .	Sym → Mac	Lin (2004); Çetingül & Geban (2005)
OH <sup>-</sup> is not in acid solution. Only there are H <sup>+</sup> in acidic solution. In the basic solution contained only OH <sup>-</sup> .	Sym → Mic	
Strong acids will have a low pH while the weak acid will have a pH close to bases.	Mic → Mac	Çetingül & Geban (2005)
Acids have pH values but does not have the value of pOH. pOH is only for bases.	Mac → Sim Sym → Mic	
Concentration from hydrogen ions is only affected by the amount of hydrogen (H atoms) in the formula.	Mic → Sim	Chiu (2005)
If the concentration of HCl = 10 <sup>-8</sup> M, pH of HCl = 8 and means that HCl is base. HCl is acidic. So, there is no solution of HCl with a concentration of 10 <sup>-8</sup> M.	Mac → Sim Sym → Mic	
HCl with a concentration of 10 <sup>-8</sup> M is basic because of pH = 8. (There is no contribution of H <sup>+</sup> ions from water).	Mac → Sym Sym → Mic	Watters & Watters (2006)
Errors in the interpretation of titration curves of acids and bases	Sym → Mic Sym → Mac	Sheppard (2006)
Misconceptions in understanding the concept of a saturated solution.	Mac → Mic	Krause & Tasooji (2007)

**Description:** Mac = macroscopic level; Mic = submicroscopic level; Sym = symbolic level



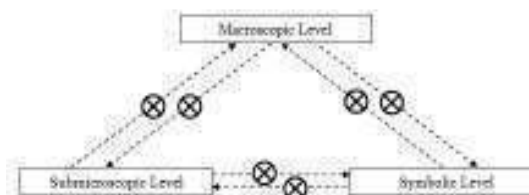


Figure 1. The Pattern of Students' Concept Mastery

Looking at existing conditions, it can be seen that the students still can not synchronize levels of chemical representation. Cheng & Gilbert (2009) stated that success in studying chemistry should involve the mental construction of the macroscopic levels, submicroscopic, and symbolic in representing the phenomena associated with the chemistry. That is, a through mastery of the concept can not only be seen from the ability to solve mathematical problems alone.

However, it was often found that educators assess students' ability in solving mathematical calculations only. This is consistent with Lee (1999) referenced by Devetak (2004). Therefore, students often think that chemistry is the science of studying only the element symbols, formulas and equations of chemical compounds. Learners do not understand the nature of the particle and describes the dynamic process (Mulford et al 2002). It is also strongly suspected to occur on the subject of this study.

#### Improvement of Student's Concept Mastery

To determine the increase of concept mastery in cognitive, it can be seen from the

results of tests of concept mastery. Descriptive data and testing of distribution data can be seen in Table 1.

Table1. Descriptive Data of Concept Mastery

	Total Score Ideal	Minimum Score	Maximum Score	Mean Score
Pre-Test	150	18	78	41.61
Post-Test		34	136	74.65

Based on the data in Table 1., It can be seen that the maximum post-test scores are higher than the maximum score on the pre-test. So it is with the mean score obtained. The results of the data analysis of each indicator increased mastery of concepts as outlined in Table 2.

Table 2 shows that there are significant differences in the overall concept mastery as well as on each of the mastery concepts indicators. Overall, it can be seen that the gain obtained at medium levels (0,30). However, it can be seen that each of GI I and GI IV have gain at low levels (0,28 and 0,19). Low gain obtained in the GI I and GI IV showed that mastery of concepts is lower than the other concepts. In more detail, the pattern of students' category change can be seen in Figure 2.

Based on the Figure 2, it can be seen that students who experienced a change of AIC Category to MCS category is the group with the most number of. In addition, there is also a learner who experienced a change in the category of AIC to MC. The pattern can be understood by reviewing process of concept formation and memory workspace.

Table2. Analysis of Concept Mastery Test

Groups of Indicator	<g>	Significance Tests of Differences*	Rank**		
			Negative	Positive	Ties
GI	0,30 (medium)	Significantly different	1	29	1
GI I	<b>0,28 (low)</b>	Significantly different	3	24	4
GI II	0,35 (medium)	Significantly different	2	28	1
GI III	0,35 (medium)	Significantly different	3	27	1
GI IV	<b>0,19 (low)</b>	Significantly different	6	22	3
GI V	0,31 (medium)	Significantly different	1	29	1

Description:

\* = Testing using the *Wilcoxon Signed Ranks Test*

\*\* = Number of students whose score change and it was shown in the test *Wilcoxon Signed Ranks Test*.

GI = Overall indicator of the Concept Mastery

GI I = Acid-base theory according to Arrhenius, Bronsted-Lowry, and Lewis theory.

GI II = The equilibrium in acid-base solution and determination of the pH of the solution

GI III = Buffer solution concepts

GI IV = Hydrolysis concepts

GI V = Concepts of solubility and solubility products

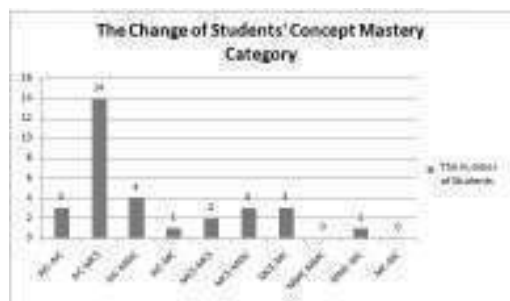


Figure 2. The Pattern of Category Change of Students' Concept Mastery

### **“There is An Elephant in My Room” an Idiom for Overload Working Memory Space**

Related to the formation of concepts, Sirhan (2007) stated that learning chemistry actually need intellectual and critical thinking because the content is full of a lot of abstract concepts. It also includes the content of solution in chemistry and chemical equilibrium. Real understanding not only requires an understanding of the key concepts but also the development of meaningful links to carry concept to be interconnected as a whole. The concept developed as new ideas are interconnected and learners are not always correct in connecting. This might direct the formation of misconceptions.

Sirhan (2007) further stated that a concept or pieces of owned intellectual thought can strengthen or even be a barrier to learning more. Barrier that occurs in GI-1 is understandable because of the inability of the students to understand and interpret the symbols, formulas, and pictures of models before learning. Tendency of education obtained by students in secondary schools shows that the symbolic form of chemical reaction equations, phase index substances, chemical formula and meaning of mathematical formulas are not interpreted properly. Thus, students may not grasp the key concepts or have not been really able to connect key concepts.

Bodner (1991) listed the factors that may lead to misconceptions on the learner. Bodner noted the problems of learning that only emphasizes memorization, learners have knowledge without understanding. In line with this research, the students can not truly understanding the atom, molecule, ion, chemical formula, as well as the symbolic and submicroscopic representation related concepts of acid-base and solubility equilibria. This might also be a key factor in their misconceptions.

Wu (2001) investigated the level of description of the learner when the formulas and chemical symbols are used, such as Cu (s), H<sub>2</sub>O (l),

and Cl<sub>2</sub> (g). Learner responses showed that the majority of them still confusion between atoms and molecules. The concept of microscopic models of atoms and molecules are so problematic. This study also showed such conditions, both before and after learning. The use of the index symbol (s), (l), (g) and (aq) to showed the phase of the substance also could not be understood and used properly by students before and after learning. Many learners or students, even after studying chemistry, still do not understand the role of the chemical formula. Some thought that the chemical formula is the abbreviation for the name than a short way to represent the composition or structure.

Actually, when the teacher introduces an idea -such as chemical formulas and chemical equations- the students may already have the knowledge or previous experience, thus leading to confusion (Sirhan, 2007). Another thing that can be highlighted is the ability of learners to interpret the titration curve. The majority of students have not been able to interpret the concept of a buffer system and hydrolysis on a curve. Thus, to meet the indicators mastery of concepts, the students would have to interpret every symbol, formula, representation in pictures, graphs and curves.

Santrock (2008) stated that the children have a lot of misconceptions that are not compatible with science and reality. They may be trying to reconcile anything that seems contrary to their beliefs. In this regard, the use of scientific language can also lead to misleading misconceptions. The language can be one of the contributors to the information overload. The problem of language, including the use of unfamiliar vocabulary (eg, ions, molecules, catalysts), familiar vocabulary leading to a shift toward chemical meaning (example: atom, saturated), the use of high-level language sounds (example: entities), and the use of double or triple negative meaning. Results showed a decrease of about one unit in the workspace memory.

Sirhan (2007) conduct research on vocabulary skills in secondary school students in Australia. Results showed that many of the words used by science teachers can not be accessed and understood by students buzzing. Research in Scotland also showed that some words that use is not standard in English-language cause misunderstanding. The use of language, including the representation of symbols, requires careful thought and caution. Language can help or hinder the interaction with long-term memory even be a source of overload working memory information (Sirhan, 2007; Taber, 2009).

Tsaparlis (2009) stated that the information passed through the filter will towards working space (or working memory), namely part of memory (mind) in which new information and interact with what is already understood and was understood. The information is molded into a form that can be saved and reused later or into a form that can be discarded because it is considered as "not meaningful". By understanding the information processing models, at least there is an important factor to explain why science it becomes difficult for the learners. That is because the language in the chemical process that takes too much. Language here also includes the use of symbols representation (Bradley & Steenberg, 2005; Taber, 2009). Thus, the students tend to memorize submicroscopic and symbolic representation in the form of words of description. As a result they are not able to imagine and represent how the processes and structure of a substance having a reaction.

## CONCLUSION

Based on the research results and discussion, it can be concluded as follows. % N-gain of concept mastery at "medium" level category (0,3). It was only 5 preservice teachers (from 31 preservice teachers) showed the ability to connect the macro-submicro-symbolic level. The difficulties of teaching chemistry due to the barrier in the processing of information within working memory space. The mastery of symbolic level was an important source of this barrier.

## Acknowledgement

The author would like to thank for BPKLN (Biro Perencanaan dan Kerja sama Luar Negeri), Ministry of Education and Culture for the support cost in this research through Beasiswa Unggulan.

## References

- Abraham, *et al.* (1992). Understanding and Misunderstanding of Eight Grades of Five Chemistry Concept in Text Book. *J. Research in Science Teaching*. 29: 105-120.
- Bergquist, W., & Heikkinen, H. (1990). Student ideas regarding chemical equilibrium. *Journal of Chemical Education*. 66:1000-1003.
- Bradley, J.D. & Steenberg, E. (2005). Symbolic Language In Chemistry – A New Look At An Old Problem. Thesis Article. Pretoria: University of South Africa (UNISA).
- Çalık, M. (2005). A Cross-Age Study On The Understanding of Chemical Solutions and Their Components. *International Education Journal Shannon Research Press*. 6: 30-41,
- Çetingül, P.I. & Geban, O. (2005). Understanding of Acid-Base Concept by Using Conceptual Change Approach. *H.U.J. Education*. 29: 69-74.
- Chaiyapha, P., Chayajarus, K., & Chairam, S., (2011). Investigation of High School Students' Understanding of Acid-Base Chemistry Based on Jigsaw Metho. *Pure and Applied Chemistry International Conference 2011*. 139-142.
- Cheng, M., & Gilbert, J. K. (2009). Towards A Better Utilization Of Diagrams In Research Into The Use Of Representative Levels In Chemical Education, (Ed: Gilbert, J.K & D. Treagust), *Multiple Representation in Chemical Education: Models & Modelling in Science Education*. Dordrecht, Springer, 55-73.
- Chandrasegaran, A.L., Treagust, D.F., & Mocerino, M. (2007). The Development of A Two-Tier Multiple-Choice Diagnostic Instrument for Evaluating Secondary School Students' Ability to Describe and Explain Chemical Reactions Using Multiple Levels of Representation. *Chemistry Education Research and Practice*. 8: 293-307.
- Chittleborough, G. & Treagust, D.F. (2007). The Modelling Ability of Non-Major Chemistry Students and Their Understanding of The Sub-Microscopic Level. *Chemistry Education Research and Practice*. 8: 274-292.
- Cohen, L., Manion, L., & Morrison, K. (2007). *Research Methods in Education Sixth Edition*. New York, Routledge.
- Davidowitz, B. & Chittleborough, G.D. (2009). Linking the Macroscopic and Sub-microscopic Levels: Diagram, (Ed: Gilbert, J.K & D. Treagust), *Multiple Representation in Chemical Education: Models & Modelling in Science Education*. Dordrecht, Springer, 169-191.
- Devetak, I., *et al.*, 2004. Submicroscopic Representations as A Tool for Evaluating Students' Chemical Conceptions. *Acta Chim Slov*. 51: 799-814.
- Drechsler, K. & Schmidt, H. (2005). Upper Secondary School Students' Understanding of Models Used in Chemistry to Define Acids and Bases. *Science Education International*. 16: 39-53. *International Council of Associations in Science Education*.
- Eilks, I., Moellering, J. & Valanides, N. (2007). Seventh-grade Students' Understanding of Chemical Reactions: Reflections from an

- Action Research Interview Study. *Eurasia Journal of Mathematics, Science & Technology Education*. 3:271-286.
- Gabel, D. L., Samuel, K. V., & Hunn, D. (1987). Understanding the particulate nature of matter, *Journal of Chemical Education*, 64:695-697.
- Gilbert, J.K., & Treagust, D.F. (2009). Introduction: Macro, sub-micro and symbolic representations and the relationship between them: Key models in Chemical education. (Ed: Gilbert, J.K & D. Treagust), *Multiple Representation in Chemical Education: Models & Modelling in Science Education*. Dordrecht, Springer.
- Hake, R.R. (1998). Interactive-engagement Versus Traditional Methods: A Six-thousand-student Survey of Mechanics Test Data For Introductory Physics Courses. *American Association of Physics Teachers-American Journal of Physics*. 66: 64-74,
- Johnstone, A.H. (200a). Teaching of Chemistry - Logical Or Psychological?. *Chemistry Education: Research and Practice In Europe*. 1: 9-15.
- Johnstone, A.H. (2000b). Chemical Education Research: Where from Here?. *Proceeding University Chemistry Education*. 4: 34-38.
- Krause, S. & Tasooji, A. (2007). Diagnosing Students' Misconceptions on Solubility and Saturation for Understanding of Phase Diagrams. *American Society for Engineering Education*.
- Lin, J.W., Chiu, M.H., & Liang, J.C. (2004). Exploring Mental Models and Causes of Students' Misconceptions in Acids and Bases. *NARST 2004*. 1-12.
- Metin, M. (2011). Effects Of Teaching Material Based On 5E Model Removed Pre-Service Teachers' Misconceptions About Acids-Bases. *Bulgarian Journal of Science and Education Policy*. 5:274-302.
- Morgil, I. et al. (2009). Overcoming The Determined Misconceptions In Melting And Dissolution Through Question & Answer And Discussion Methods. *Chemistry*, 18: 49-61.
- Muchtar, Z. & Harizal, H. (2012). Analyzing of Students' Misconceptions on Acid-Base Chemistry at Senior High Schools in Medan. *Journal of Education and Practice*. 3: 65-74.
- Mulford, D.R. & Robinson, W.R (2002). An Inventory for Alternate Conceptions among First-Semester General Chemistry Students. *Journal of Chemical Education*. 79:739-744.
- Santrock, J.W. (2007). *Perkembangan Anak Edisi Kesebelas Jilid 1*. Terjemahan Mila Rachmawati & Anna Kuswanti. Jakarta, Erlangga.
- Santrock, J.W. (2008). *Psikologi Pendidikan*. Terjemahan Tri Wibowo. Jakarta, Kencana.
- Sanger, M.J., & Greenbowe, T.J. (1997). Common Student Misconception in Electrochemistry: Galvanic, Electrolytic, and Concentration Cells. *Journal of Research in Science Teaching*. 4:377-398.
- Sheppard, K. (2006). High School Students' Understanding of Titrations and Related Acid-Base Phenomena". *Chemistry Education Research and Practice*. 7: 32-45.
- Sirhan, G. (2007). Learning Difficulties in Chemistry: An Overview. *Journal of Turkish Science Education*. 4:1-20.
- Smith, K.J & Metz, P.A. (1996). Evaluating Student Understanding of Solution Chemistry through Microscopic Representations. *Journal of Chemical Education*. 73: 233.
- Sukardi, S. (2009). Evaluasi Pendidikan Prinsip & Operasionalnya. Jakarta, PT Bumi Aksara,
- Taber, K.S. (2009). Learning at the Symbolic Level, (Ed: Gilbert, J.K & D. Treagust), *Multiple Representation in Chemical Education: Models & Modelling in Science Education*. Dordrecht, Springer, 75-105.
- Talanquer, V. (2011). Macro, Submicro, and Symbolic: The Many Faces Of The Chemistry "Triplet". *International Journal of Science Education*. Taylor & Francis. 33:179-195
- Tasker, R. & Dalton, R. (2006). Research Into Practice: Visualisation Of The Molecular World Using Animations. *Chemistry Education Research and Practice*. 7:141-159.
- Treagust, D.F., & Chandrasegaran, C. (2009). The Efficacy of An Alternative Instructional Programme Designed to Enhance Secondary Students' Competence in The Triplet Relationship, (Ed: Gilbert, J.K & D. Treagust), *Multiple Representation in Chemical Education: Models & Modelling in Science Education*. Dordrecht, Springer, 151-164.
- Watters, D.J. & Watters J.J. (2006). Student Understanding of pH- I don't Know What The Log Actually Is, I Only Know Where The Button Is On My Calculator. *Biochemistry And Molecular Biology Education*. 34:278-284.
- Wu, H., Krajcik, J.S., & Soloway, E. (2001). Promoting Understanding of Chemical Representations: Students' Use of a Visualization Tool in the Classroom". *Journal of Research In Science Teaching*. 38: 821-842.

## DEVELOPING A CHEMISTRY MAGAZINE AS A LEARNING RESOURCE OF YEAR-10 STUDENTS OF SENIOR HIGH SCHOOL

**Eko Yuliyanto**

Chemistry Education Department, Muhammadiyah Semarang University  
email: ecko\_mch@yahoo.com

### **Abstract**

*The study aims to: determine the feasibility of chemistry magazine in the aspects of the material, presentation, language, and images. This study was a research and development conducted with Borg and Gall Model's, i. e preliminary research; determining the purpose of product; designing format of product and designing assessment of chemical magazine quality; validation by peer reviewer, material expert, media and learning expert; and limited try out. The instruments to collect the data were the magazine's validity sheets, and students' response sheets. The results of developing the chemistry magazine, the magazine is appropriate based on material, presentation, picture and language aspects.*

**Keywords:** chemistry, magazine, resource

### **INTRODUCTION**

There are many factors that can affect the learning process in the classroom. These factors can be derived from students or teacher. Quality of learning in the classroom can be obtained from the student responses during learning. Based on a survey in SMAN 1 Mlati, the information obtained 85% students of year-10 class (of 93 students) declared that chemistry teachers in teaching unattractive. Some validity is a lack of learning by practice, the lack of intermezzo with laughter, the subject matter is too fast explanation, teachers do not understand the condition of the students, the learning situation is too tense, no distraction using the game, there is no intermezzo in the form of stories, and the media or the monotony of learning resources. In addition students want to learn chemistry availability of a full color book.

This indicates the motivation of students in learning chemistry is not optimal and it is also thought to lack the motivation to learn can lead to low student creativity. This will potentially result in achievement of students studying chemistry. This is due to the relationship between motivation and creativity. De Jesus, et. Al (2013), Nair & Alyakumi (2011), and Sarsani (2008) states that between motivation and creativity have a correlation.

Sheldon's (1995), Amabile (1986:15), Nair and Alyakumi (2012), and Liu, et. Al (2012) states that if the intrinsic motivation of students is high then the creativity of students will also be high, as well as better.

There are some efforts to improve the quality of learning. One of the way is through the development of learning resources, especially books, textbooks, and other print media. The presence of factors that affect the process and the learning outcomes of students make students have difficulty in understanding the subject matters. This will make them to look for a source of learning outside the classroom. Therefore, they try to learn to be independent students with the help of learning resources in accordance with the wishes of students. It makes educators respond to these conditions, in particular by providing an exciting learning resources. Based on the results of a survey conducted in SMAN 1 Mlati indicating that 80% students of year-10 (of 91 students) like magazines as reading material. It is the potential for developing a chemical magazine as a source of learning chemistry.

Based on the information in SMAN 1 Mlati no individuals who developing chemistry magazine. Chemistry teachers in SMAN 1 Mlati also have not used chemistry magazine in the learning process of chemistry. Hence the need to develop the magazines as a source of learning chemistry, so the students are motivated to learn chemistry subject. The learning process is carried out by self-students must be supported by an engaging learning resources and in accordance with the interests of students. This material of magazine in accordance with the Standards Content, so that the presence of this magazine can help students to learn independently and get the meaningfulness of the chemistry subjects being studied. In addition magazine in the learning process use learning approaches, as it will greatly assist in the transfer process information effectively and efficiently.

Some of the approaches used in the chemistry learning approach was Science, Environment, Technology, and Society (SETS). The SETS approach was used in the developing of the

magazine because it has certain advantages in the process of information transfer. The language used in this magazine was popular scientific language, so that the material in the magazine will be easily understood. The dynamic impression will be seen in every design layout of each page in the magazine so arranged as to avoid monotony and give rise to new or fresh atmosphere. In addition, using of collaborative approaches SETS, Chemo Entrepreneurship (CEP), and the application of Mind Mapping in writing subject matter, are expected to create "Joy full Learning".

The problems studied and identified in this study are educators in SMAN 1 Mlati not yet using chemistry magazine in the learning process. There is a tendency motivation of students in SMAN 1 Mlati. The motivation's students of year-10 class in this case is quite low because the lesson is not interesting. There was also tendency in creativity, the creativity of students is still limited in this case because the learning process is not attractive.

## RESEARCH METHODS

This study is a Research and Development. The model used in this research is development model of Borg and Gall (1983: 772). Borg and Gall model consists of ten steps are procedural models. In this study only done up to step 7 on the procedure on a model Borg and Gall. The study was conducted from December 2012 to May 2013. Where the research was done in year-10 class of SMAN 1 Mlati, Sleman, Yogyakarta. This research was conducted through seven development stages: a preliminary study; formulation of objectives; design and manufacture a product format magazines chemical assessment instruments; chemical preparation of the draft magazine; validation by peers, materials experts, media specialists and learning, chemistry teachers, and small group trials.

## THE DATA, INSTRUMENTS, AND THE COLLECTION TECHNIQUES OF DATA

The data obtained were aspects of data quality magazine content, presentation and language and images by peer reviewers, expert material, and instructional media experts, reviewers and students. The instrument used in this study are chemistry magazine quality instruments.

Variable data quality analysis for chemistry magazine: criteria of assessment be converted into a score, with a scale model of the five Likert's scale (S. Eko Putro Widoyoko, 2012: 106), then the total score and the mean of total score was calculated for each sub-component chemical magazine.

The average total score of each sub-component was calculated by the formula:

$$\text{Formula: } \bar{X} = \frac{\sum X}{n}$$

Information :

$\bar{X}$  = the mean score for each sub-component  
 $\sum X$  = the total score of each sub-component  
 $n$  = the number of grain sub-components

The total score and the average total score was calculated for each component, then the average final score obtained was converted into a qualitative level of product quality with a 5 scale conversion categorization guidelines (Sukardjo, 2008: 83) as presented in Table 1.

Table 1. Scale of Five Criteria

Range Score	Category
$4,206 < \bar{x}$	Very Good
$3,402 < \bar{x} \leq 4,206$	Good
$2,598 < \bar{x} \leq 3,402$	Neither
$1,794 < \bar{x} \leq 2,598$	Bad
$\bar{x} \leq 1,794$	Vary bad

## RESULTS AND DISCUSSION

### The preliminary study

Based on observations and extracting information using a questionnaire of as many as 93 students of class X data showed that 83% of students already have a chemistry book, 84% of students stated the chemistry books that there are in school not adequate for students, 95% of students states never read a chemistry magazine, 85% of students stated that learning chemistry in school is not interesting, 80% of students stated that likes to read magazines. Based on preliminary studies, we can conclude that learning of chemistry in year-10 class of SMAN 1 Mlati not be able to attract the students and to follow the learning chemistry well. It has the potential lacking of motivation of students in participating in learning chemistry. So, it is necessary to develop learning resources, and can to attract the students to study chemistry.

### Formulation of Objectives

The purpose of the learning process in terms of the materials used in the learning process. Preparation of materials based Standards Competency, Basic Competency. Standards Competency used are understand the properties of organic compounds and functional groups on the basis of macromolecular compounds, while the basic competency used is to describe the peculiarities of the carbon atoms in the form of hydrocarbons, hydrocarbons classified based on their structure and relation to the nature of the compound, explaining the process of formation and

separation techniques petroleum fractions and their uses, and describe the functionality and composition of hydrocarbons in everyday life in the field of food, clothing, housing, commerce, art, and aesthetics.

### Designing the Format of Products

The format layout refers to the magazine on the market. The layout of the magazine referenced on the market that covers the front and back cover, editorial, content, number of pages, paper size, paper type, font size, and the preparation of section layout. The magazine consists of a front cover, contents page in the form of rubrics and back cover, and chemistry magazine consists of 78 pages.

### Construct of Instrument Chemical Magazine

The assessment instrument for the chemistry magazine was developed based on assessment instruments on textbooks (Pusbukkur, 2010:1). The instrument chemistry magazine consists of three components. The components are the feasibility of the material, the feasibility of presenting and appropriateness of language and images. This instrument consists of 41 items statement. This instrument before used to assess the chemistry magazine was validated by Prof. Dr. Sukardjo.

### Preparation Draft of Chemistry Magazine

The Chemistry magazine was developed by In design CS5 software and Corel Draw X3 software. The Magazine designed in the paper which the size 19.3 cm x 26 cm.

### Results Validation Chemistry Magazine

The chemistry magazine after validated were obtained scores on the material aspects, presentation, and language and images. Validation was done by a chemistry magazine colleague, materials experts, media experts and learning and chemistry teacher. The results of chemistry assessment of feasibility magazine material, presentation language and picture presented in Table 2.

Table 2. Data Assessment of Chemistry Magazine by colleague

Aspects of assessment	Respondent	Score	Mean of Scores	Category
Feasibility of Material	I	4,125	4,208	Very good
	II	4,125		
	III	4,375		
Feasibility of Presentation	I	4,176	4,216	Very good
	II	4,000		
	III	4,470		
Feasibility of language and images	I	4,250	4,250	Very good
	II	4,125		
	III	4,750		

The results assessment chemistry magazine of feasibility magazine material by materials experts a complete can be seen in Table 3.

Table 3. Data assessment of chemistry magazine by materials experts

Aspects of assessment	Score	Category
Supporting the purpose of education	4,33	Very good
Compliance with science and technology	4,00	Good
Compliance with the reasoning learners	3,33	Neither
Average number of total score	3,88	Good

The results assessment of magazine by chemistry teachers fully presented in Table 4.

Table 4. Data Assessment of Chemistry Magazine by chemistry teacher

Aspects of assessment	Respondent	Score	Mean of Scores	Category
Feasibility of Material	I	5,000	4,225	Very good
	II	4,125		
	III	3,500		
	IV	4,250		
	V	4,250		
Feasibility of Presentation	I	4,647	4,094	Good
	II	3,941		
	III	3,529		
	IV	4,412		
	V	3,941		
Feasibility of language and images	I	4,625	4,163	Good
	II	4,125		
	III	3,688		
	IV	4,438		
	V	3,938		

The result of assessment chemistry magazine by expert instructional media are presented in Table 5.

Table 5. Data assessment of chemistry magazine by expert instructional media

Respondent	Aspects of assessment	Score	Category
Systematic of presentation	Easiness to understand	4,33	Very good
	Develop creativity	5,00	Very good
	Develop motivation	4,33	Very good
Develop thinking skills	Develop thinking skills	5,00	Very good
	Feasibility of language and images	4,50	Very good
	Understanding of language	4,66	Very good
Appropriate of language	Appropriate of language	4,00	Good
	Appropriate of images	5,00	Very good
	Font of magazine and physical quality	5,00	Very good
Mean of total scores		4,65	Very good

### Small Group Try Out

Try out conducted on a small group of 8 people. This small try out group consisted of assessing the feasibility of the material, presenting

the feasibility and appropriateness of language and images. Fully presented in Tables 6, 7 and 8.

Table6. Data assessment of chemistry magazine  
by the material aspects of students

Aspects of assessment	Respondent	Score	Mean of Scores	Category
Feasibility of Material	I (high)	4,000	4,141	Good
	II (high)	4,250		
	III (high)	4,125		
	IV (middle )	3,750		
	V ( middle )	4,250		
	VI (middle)	4,375		
	VII (low)	4,500		
	VIII (low)	3,875		

Table7. Data assessment of chemistry magazine  
by students aspect of the presentation

Aspects of assessment	Respondent	Score	Mean of Scores	Category
Feasibility of Presentation	I (high)	3,941	3,919	Good
	II (high)	4,059		
	III (high)	3,941		
	IV (middle )	3,588		
	V ( middle )	4,000		
	VI (middle)	3,824		
	VII (low)	4,118		
	VIII (low)	3,882		

Table8. Data assessment of chemistry magazine  
by students aspect of language and images

Aspects of assessment	Respondent	Score	Mean of Scores	Category
Feasibility of language and images	I (high)	4,250	4,250	Very good
	II (high)	4,438		
	III (high)	4,250		
	IV (middle )	4,125		
	V ( middle )	4,063		
	VI (middle)	4,188		
	VII (low)	4,188		
	VIII (low)	4,500		

### Final Product of Assessment Feasibility Material

Assessment of the feasibility material of a chemistry magazine by expert indicates that a minimum quality magazine categorized as “good”. The results assessment of the chemistry magazine in the material aspects by peers was “very good” category, assessment the chemistry magazine materials expert was “good” category, and chemistry teachers assess chemistry magazine “very good” category, while the limited try out judge chemistry magazine was “good” category. The assessment of chemistry magazine covers carrying the material aspects of educational objectives, compliance with the development of science and technology, and compatibility with the reasoning of students. The average scores given by experts material is the lowest score if compared from the other validation because it is based on an

assessment by experts on the material aspects of the matter: the suitability of magazine with science and technology categorized “good”, and the suitability of contents in a magazine with reasoning students also categorized as “Neither” while the carrying capacity magazine for the educational objectives are categorized as “very good”. A learning resource was said to be good media if the material has been published in accordance with the level of development that became the target object. The chemistry magazine was conceived and was dedicated to the students of senior high school. The materials presented in the magazine different from ordinary chemistry books. The materials in the magazine were presented in the form of chemistry rubrics material interrelated with one another, whereas in terms of scientific truth remains aligned with the field of chemistry.

### Feasibility Presentation

The peers assesses chemistry magazine with “very good” category, the chemistry teachers assesses the magazine with “good” category, and instructional media expert assess the magazine “good” category while the students in limited try out assesses chemistry magazine “good” category. The aspects assessment of the feasibility presentation on chemistry magazine include: the using of systematic presentation, easiness to understand, develop motivation, develop thinking skills, develop academic skills, and develop creativity.

Based Pusbukkur (2010:1) the feasibility of a non-text book there is a few things one of which is the feasibility presentation. It is becomes important that every non-text books including chemistry magazine. A non-text books was said to be good media if the quality of the presentation of the material, categorized as “good” category. The feasibility of chemistry magazine in presentation categorized as “good” category. So the chemistry magazine is feasible used as a learning resource for students in senior high school. Presentation of the material in the magazine is different from ordinary chemistry books, the one that sets it apart is the rubric. The differences magazine unusual chemistry and chemistry books can be seen in Table 9. The Rubric is a common theme in the magazine and content in each different section. Every magazine section on the development of this chemistry has a goal orientation in chemistry magazine, which is to improve learning motivation and attitude on the creativity of students. In this magazine presented rubrics to improve motivation oriented balanced



and also complementary with rubrics to improve creativity as contained in Table 9.

Table 9. Rubric orientation in Magazine

Rubrics	Rubric orientation in Magazine	
	Motivation	Creativity
Topik utama	√	√
Eksperimen	√	√
Tahu lebih jauh	√	√
Amazing!	√	-
Profil ilmuwan	√	-
Kimiawan berwirausaha	√	√
Kimiawan tertawa	-	√
Apakah aku dan untuk apa aku?	-	√
Info senyawa-senyawa kimia dan lambang bahayanya	-	√
Mind mapping	√	√
Chem-browsing	-	√
Motivasi	√	-

### Feasibility Language and Images

The Peer assess chemistry magazine with the “very good” category, the magazine assessed by chemistry teacher with a “good” category, and instructional media experts assess the magazine “very good” category while the limited try out group assess chemistry magazine “very good” category. The assessment of chemistry magazine covers several aspects, namely the suitability images and language, understanding of language or images, correct use of language, correct use of images, and use of fonts as well as the physical quality magazine paper. The language and images have an influence on the media or learning resources.

Table 10. The Comparison Text book and Chemistry magazine

Aspects	The type of educational books	
	Text book	Chemistry magazine
Materials	Material related to standards content	Materials related to the partial or one part in the standards content
Organization of the materials	Organized into units or Chapter	The material arranged in the a unique rubrics
Purpose	The material of a subject of knowledge and science	The contents suitable to study the matter and as enrichment material or reference
The Purpose of Use	as a basic handbook for students	As an enrichment book for students
Evaluation Instrument	There is evaluation instrument	There is not an evaluation instrument

### Magazine

The visual quality of a media can be viewed from several things. Smaldino, et.al (2008:60) states that visual elements in the design that arrangement, balance, color, legibility, while the appeal of text elements include style, size, spacing, color and use of capital. According Pusbukkur (2010:1) the feasibility of a non-text book there are several things that a feasibility material, presenting feasibility, feasibility graph and linguistic. It becomes important that every non-text books including chemistry magazine. A non-text books said to be good if the quality of its linguistic, material, presentation and graph categorized minimum was “good”. The results of the development of chemistry magazine on feasibility of language and images was categorized “good”. So, the magazine is feasible to be used as a learning resource for students in senior high school. The chemistry magazine was a visual media that is expected to increase the motivation of students. Smaldino (2008: 56) states that:

*“visual can increase interest in a lesson. Interest enhance motivation. Visual can motivate students by attracting their attention, holding their attention, and generating engagement in learning process”*

### CONCLUSIONS AND RECOMMENDATIONS

#### Conclusions

Based on the research that has been done can be summed up as follows: Chemistry Magazine based on the assessment by peers, materials experts, media and learning expert, chemistry teachers, and students of material aspects, presentation, linguistic and images declared fit for use as a source of self-learning in the process learning chemistry.

#### Suggestion

Based on the results of the implementation of the research, there are some things that are still not optimal in the development of chemistry magazine therefore there are some advice given by researchers are:

1. Magazine printing in order to reduce production costs using the cover of a magazine on the ivory paper 230 grams and the content section using HVS 80 gram paper (color full).
2. The Chemistry magazine need for further testing, which is done by cooperating with MGMPs forums such as chemistry teacher, so it will get more and more representative input on the needs of the students in the class.

## References

- Amabile, T.M., Hennessey, B. A. & Grossman, B. S. (1986). Social influences on creativity: the effects of contracted for reward. *Journal of Personality and Social Psychology*, 50, pp.14-23.
- Borg, W.R. and Gall, M.D. (1983). *Educational research: an introduction fourth edition*. New York: Logman.
- Jesusa, S.N.de, Rusb, C. L., Lencs, W., and Imaginário, S. (2013). Intrinsic motivation and creativity related to product: a meta-analysis of the studies published between 1990–2010. *Creativity Research Journal Volume 25, Issue 1, 2013*.
- Liu, E. Z-F., Lin, C-H., Jian, P-H., and Liou, P-Y. (2012). The dynamics of motivation and learning strategy in a creativity-supporting learning environment in higher Education. *The Turkish Online Journal of Educational Technology*. January, volume 11, Issue 1.
- Lewis, J. J. (2004). The independent learning contract system: motivating students enrolled in college reading courses. *Journal Article Excerpt Vol.41, 2004*.
- Nair, S. and Alkiyumi, M.T. (2011). Investigation the relationship between intrinsic motivation and creative production on solving real problems. *Journal Sosiohumanika*, 4(2) 2011.
- Pusat Perbukuan Depdiknas. (2010). *Pedoman penilaian buku pengayaan pengetahuan*. Jakarta: Depdiknas diakses melalui <http://puskurbuk.net>.
- Reynolds, C.R., Livingston, R.B., and Willson, V. (2010). *Measurement and assessment in education 2<sup>nd</sup> Edition*. New Jersey: Pearson Education International.
- Sarsani, M.R. (2008). Do high and low creative children differ in their cognition and motivation?. *Creativity Research Journal Volume 20, Issue 2, 2008 pages 155-170*.
- Smaldino, S.E., Lowther, D.L., and Russell, J. D. (2008). *Instructional Technology and Media for Learning 9<sup>th</sup> edition*. New Jersey: Pearson Education.
- S. Eko Putro Widoyoko. (2012). *Teknik penyusunan instrumen penelitian*. Yogyakarta: Pustaka Pelajar.
- Stein, A. (2011). Fashioning teenagers: A Cultural history of seventeen magazine. *Journalism and Mass Communication Quarterly Autumn 2011; 88, 3; ProQuest Page. 659*.
- Sugiyono. (2008). *Metode penelitian kuantitatif, kualitatif, dan R & D*. Bandung: Alfabeta.
- Sukardjo & Lis Permana S. (2008). *Penilaian hasil belajar kimia* (tidak diterbitkan). Yogyakarta: Universitas Negeri Yogyakarta.

## IMPROVING LEARNING OUTCOMES THROUGH THE APPLICATION OF COLLABORATIVE LEARNING MODEL DIRECT AND COOPERATIVE TYPE STAD ON MACROECONOMIC THEORY COURSES

**Luqman Hakim**

Universitas Negeri Surabaya  
luqmanhakimb114@gmail.com

### **Abstract**

*The low outcome of economic education students was caused by characteristic of the substance introduction to economics which abstract, theoretic, and teacher centered. So that, the implementation direct learning and **Student Team Achievement Divisions (STAD)** can make the substance introduction to macroeconomics becomes easier to be accepted and understood by students. The purpose of this research is to describe the level of completeness student's learning outcome at introduction to macroeconomics subject. The research result of the implementation direct learning and Student Team Achievement Divisions (STAD) is student activities at each meeting have a significant escalation. The level of completeness student's learning outcome at aggregate demand and supply substance have a significant escalation from 68,6% at first cycle become 82,9% at second cycle, and then become 91,4% at post test. The student's response about the implementation direct learning and Student Team Achievement Divisions (STAD) contextual is positive.*

**Keywords:** STAD, direct learning, learning outcome

### **BACKGROUND**

Learning is a process that processes input into output using the instrumental. Instrumental inputs used by lecturers will process the students as inputs into output quality. Instrumental inputs include building infrastructure, educational facilities, curriculum, instructional models, administration and other instruments.

Learning model as an instrument of education plays a role in processing students to obtain better learning results. The results of the study describe the product as a mirror learning student success in learning. Learning allows the process that allows the acquisition of good learning outcomes. Cagne (1985), the results obtained through learning events learning event.

From the background described above, the formulation of the problem in this study were : (1) How does the application of direct and collaborative learning model STAD cooperative learning for macroeconomic theory courses on Economic Education Program. (2) How does the course learning outcomes at the macro economic theory Studies Economics Education S - 1 with the direct and collaborative learning model STAD cooperative learning. (3) Are there any constraints faced by the students in the Economics of Education Program follows the use of direct and collaborative learning model STAD cooperative learning in introductory courses macroeconomic theory.

Through collaborative model of learning direct and cooperative type stad expected students could understand the concept of theory either individually, makro groups and classes. The concept of the theory makro better qualitative and quantitative will pre-sighted not only comprehends the theory by remembering, but also analyse and evaluate a meaning that is contained in perekonomian a country so as to study result of the students has risen. According to simanjuntak (1985:9) learning is own efforts having knowledge. While sudjana (1996:5) defines learning as a process that characterized by the presence of change at yourself in someone. Change as a result of a learning process can be shown in various forms as changed knowledge, understanding, the attitudes and behaviors, skill, prowess, a change of habits as well as other aspects that belonged to individuals. The definition of other about learning given garry and kingsley (1970: 15) in sudjana learning is the process of changing the original comportment through experience and trial.

Learning according to slameto (2003: 2) psychologically is "a process of change namely change comportment as the result of interactions with surroundings in meet the needs of his life or learned: a process of efforts by someone in order to gain a change comportment new overall, as the result of experience of themselves in the interaction with environment".

Skinner in dimiyati (1999:9) said, "learning is a behavior at the time of a learned person then responnya meliorate". So that by learning then they will undergo a change comportment. Learning according to azwar (2004: 164) in the most general sense is any behavioral change caused by experience or as a result of the interaction of individuals with their environment. Besides according to djamarah (1994: 20) learning is a activities performed in a conscious to get a number of an impression from the ingredients being studied.

Meanwhile, according to azwar (2004:164) learning is any behavioral change caused by experience or as a result of the interaction of individuals with their environment, hence people are openly against changes that occurred to him. Learning according to djamarah (1994:21) is "a activities performed in a conscious to get a number of an impression of material that has been studied and is a who has the goal that is the occurrence of a change in self of the individual".

Learning cooperative type stad learning cooperative type stad arranged in an attempt to improve liveliness and participation siswa, accompanying the student with experience attitude leadership and make a decision in a group, as well as provide opportunities on the kids to interact and learning together students with different backgrounds. Learning cooperative type stad could also improve the performance of students in the duties of academic, superior in helped students in translated concepts difficult, motivates students to think more deeply and critically. Learning cooperative used for melatih ketrampilan-ketrampilan cooperation and integration. (trianto, 2007).

According to slavin in ratumanan (2004) the activity of learning cooperative can play a role in many lessons. In one particular subject learning cooperative can be used to three the purpose of different. For example, in both the students work as certain groups 'm trying to find something (e.g., economic cost of solving a problem acceptance and the balance aggregate with the approach of qualitative and quantitative approach) after the hour is completed, students can be employed as groups discussion. Finally students get a chance work together to ensure that all members of the group has mastered that lesson.

## METHOD

A kind of this research appertain to research qualitative with the kind of research classroom action research (research the act of class) (hopkins, 1993:48), that is oriented toward the quality of

learning (improvement instruction oriented). Subjects of a course called sedangkan basic economic theory makro s-1 education program economic subjects, namely matter demand and a supply aggregate.

## The Procedure of Research

According to kemmis and mc taggart (1998), the procedure of research in the act of class, include: (1) a plan of action; (2) the act of research; (3) observation; (4) the reflection and (5) of planning back.

## The Cycle of Research

The research covering two breeding cycles, namely (1) first of aggregate demand, (2) a second about the offer an aggregate. Each carpel cycle use of syntax research consisting of the plan, the act of, observation and reflection.

First cycle includes: (1) of planning namely: explain material that will be presented in learning, specifically, formulated the goal of teaching give a test, prerequisite distributed to student, teaching materials assigning university students to read the material brash aggregate demand, and distributed sheet activities a student. (2) the act of. Is the implementation of the poses belajar-mengajar by using model in class. (3) observation. To observe and record comportment student when learning and observe and record comportment model. (4) reflection. Conduct a study on the implementation of the process of belajar-mengajar that has been done. (5) discuss and evaluation with an observer used as the basis of analyzing data and the result is the condition of the end.

Second cycle includes: (1) of planning namely: the things that are obtained from the cycle i and from the results of the discussion and evaluation with an observer in the cycle i. (2) the act of. Is the implementation of the poses belajar-mengajar by using model in class. (3) observation. To observe and record comportment student when learning and observe and record comportment model. (4) reflection. Conduct a study on the implementation of the process of belajar-mengajar that has been done. (5) discuss and evaluation with observers.

The technique of collecting data in this research is reducing the data is an activity selection, focusing, and simplification of the data which began on collecting data until the preparation of the report research. The data referred to covering transcript the implementation of learning macro economic theory in the lecture by the application of learning through direct and cooperative, model of

learning test result the interview the results of the poll, the observation and note the field. The activities of the simplification of the data has been accumulating intended to get information that is clear and significant so as to be accounted for. Presentation of data done by means of composing a narrative bit on information that has been obtained from the reduction that would give the withdrawal of conclusions and taking action. The data has been served furthermore made interpretation, and evaluation this can include the completion of about: (1) the difference between the design and implementation of the action; (2) the need for change of action; (3) of alternative action which is considered proper; (4) the perception of researchers, a friend peers who engages in the observation of the field of and planning for action that has been conducted; (5) the obstacles and why constraint it appears and so forth. The withdrawal of a conclusion is to give a conclusion against the result of interpretation and evaluated. The event includes the meaning of data and give an explanation. Unverified was validity of data that is inferred, next conducted activities unverified, is testing the truth solidity, and aptness makna-makna that has emerged from the data. This event be considered as adoption of intisari of cereal offering data that has been organized in the form of statements or sentence which briefly, solid, and meaningless. The technique of using analysis descriptive analysis of data by the percentage based on kriterium that is designed in the design of research. Kriterium study result of the effective if 70 % student gain in value at least 75.

## RESULT AND DISCUSSION

### The Cycle 1

In cycles 1, meeting 1, who be used as reference common is implementation plan of learning which is supported by an instrument observation and the instrument of learning.

#### Meeting 1 The stage any preliminary activity

The stage any preliminary activity carried out for 10 minutes first. The activity of learning prefixed to convey competence base and motivates students by lifting the theme "aggregate demand". Furthermore, given the questions to students about what would be the needs of the people in an economy the state and how their efforts to meet the need. Subjects of this basic generalized and directed to the theory of aggregate demand. In this case, explained that aggregate demand will impact on the economy of a country. A growing economy of a

country of them depending on how much demand aggregative in a the country.

The stage of the activities of the nucleus. Next phase which is done is to explain about the theory of aggregate demand consisting of the concept of aggregate demand (15 minutes). In any explanation each of the theory the request of the aggregate used the examples of real (contextual) to ease purport and understanding a student. Furthermore, demonstrated to student how to describe a curve demand and formulated aggregate demand on the basis of existing data (20 minutes). The next step exercise is terbimbing for college students to draw a curve demand aggregate(35 minutes).

The stage of the activities of the end

After the provision of exercise terbimbing finished, researchers together students merekapitulasi all the things that have been studied. After that, given the opportunity to students to ask me questions about some things into their problem. The next step is with students conclude material that has been studied very associated in real life as a form of reflection of learning. Furthermore, the rest of the time employed to work on the test cycle 1.

### The Cycle 2

The stage any preliminary activity. The activity of learning started by giving apersepsi about the enactment of the law of demand. Next raised the phenomena that occur in society, especially the phenomenon aggregate offering that is listed in the preaching of the mass media (editorial main newspapers), as an example the extinction of kerosene in jakarta. By associating the two things, researchers mean to explain that there is some factor influence offer aggregate (5 minutes).

### The Core Activities

Next phase is provides a description of factors that affects the offer an aggregate. (15 minutes). Furthermore, students organized in small groups. Each group consists of 4-5 students and heterogeneous. Any of a group of negotiating to work on worksheets student (mfi). Micro financial institution mfi that we use is micro financial institution mfi offer an aggregate. The process of learning that takes place is: (1) any group of allotted time for 20 minutes to work on third part in mfi. (2) a group who are selected randomly presented the results of diskusinya for 10 minutes. (3) 15 minutes latter is used for questions. In this part of scientists participate as an observer and emend the results of an answer student if there is a mistake.

The stage of the activities of the end. After a discussion finished, with students all the results of the discussion direkapitulasi. After that, given the

opportunity to students to ask me questions about some things that will be a problem them in the exercise that discussion. Furthermore, the results of the discussion is inferred by associated in real life closer to more material that they ve learnt with the environment a student. Thus, what have they learn useful for them (10 minutes). Furthermore, the remaining time for 25 minutes used to work on the test cycle 2.

Based on presentation of data the research has been mentioned and in this part be raised discussion research results that have done, as follows:

### **The implementation of learning**

#### **The cycle 1.**

The main obstacles facing difficulties observation activity is the performance of a student. This is due to the number of students who too much crowded and a rowdy because the turn of the hour is just finished. Hence, observation of just devoted to fifteen students chosen at random.

Besides problems or other obstacle appears on cycle i can diidentifikasi as follows: (1) student not used scientific analyses are required to think and solve problems found in mfi. (2), in discussion with student not used to express his opinion individually. (3) the voice sounded researchers relatively less clear. Kendala-kendala to resolve the efforts among others: (1) providing positive strengthening to students. (2) is strengthening the positive improved confidence student (3) in the cycle lecturer initiative to use wireless to sound lecturer can reach to the class.

#### **The cycle 2.**

In the implementation of the cycle ii, relatively does not appear constraints that have been significant enough. So that learning process runs more effective and efficient. This condition is much caused by more students ready and terkondisikan to receive matter. In addition, students also no longer lumpish or more bold to convey them their opinions. Observation activities in the performance of students also elected five belash student at random. Progress has been achieved on a cycle ii is as follows: (1) student has been able to develop their own scientific way of thinking and mengkonstruk understanding of their own. (2) student has been able to declare their aspirations individually in the discussion together. An atmosphere of discussion together into more evenly and not dominated by certain groups. Student participation in the process of learning is getting higher. (3) student can predict against a couple of things probable to happen in the solution

of every case with looked at the problem from a different angle.

#### **The activity of a student**

Observation of the activity of students performed in implementing the cycle. The activity of a student who observed covering the activity of performance and cooperative. Based on the result analysis above then can be inferred that does not happen increasing the activity of students significantly. A diagram 1 showing you averages appraisement performance of a student for worksheets student 1 and 2 especially on the formulated function.

#### **Skill cooperative student**

Every student cycle cooperative observation activity carried on different groups. In cycles 1 and 2 observation deftness cooperative carried on 5 group that has determined at random. Overall cooperative skills and lowest siklusnya is tending to decline in every skills are not in duty was to average. Not residing in duty mean the group members are silent or execute activity. Low percentage exuded high activity of student so that discussion seems more lively and active.

Nor is the low skills are not in duty, deftness taking a turn and share duty is craftsmanship with average highest luminance siklusnya. It shows that most students ve been brave to declare his opinion and mutual cooperate through the distribution of duty. So that the discussion luminance group not only dominated by members of a particular group course. Deftness cooperative other which tended to rise in every siklusnya is the capacity really appreciate others, heard actively and ability ask. Third skills this had made the process of discussion be more dynamic.

While skills invite other people to speak declined in any siklusnya. The decrease in skills it indicates that every student has been bold to give his opinion without having to be prompted by a friend diskusinya. While skills examine exactness tended to be stable at each siklusnya which means the results of the discussion and a report of work remains focused and comprehensive.

Response student against of learning. Based on the results of study of a student assume learning process on any material by using approach langsungl aggregate demand is nothing new. It was proven by about 34,29 % say yes, the remaining 65,71 % answer no. It was because the model of learning directly they have got before. However about 57,14 % student said that the way of teaching teachers new one. The rest of 42,86 % say no. Referring to the results of an interview with some

students obtained data, that learning process and the manner of university professors teach tending to new so far they learned the science of economics in teoritik and teacher tends to uses the method of talks in conveying matter. So far they regard the science of economics as the science which teoritik and abstract. And so that in learning process often arising boredom.

Student response improvement seen in cycle 2 it is because of the way includes a new teaching for students, so students are enthusiastic in following the teaching-learning activities are high. According to them by implementing approaches STAD by lecturer makes economics as the science of real or tangible and practical teoritik not impressed. In addition to this way of teaching faculty also provides its own color in economic studies. The feelings of students for coursework and classroom atmosphere was fun. This statement is supported by about 82,86% of students stated that they felt happy for coursework and 91,43% stating the class atmosphere of fun. This indicates that the application of the model is able to create a climate that STAD conducive to learning, especially in introductory economics courses were so far known by some students as subjects that are relatively difficult to grasp. The remaining about 17,14 % said that they do not feel happy in following perkuliahan and 8,57 % said the class less pleasing. However, in the aspect of time given professors, allocation about 85,71 % said that students allocation of time given enough to solve any matter. The rest 14,29 % claimed that time allotted inadequate. Enough time given is also supported by the use of language internal mfi understandable. Some students 88,57 % said mfi compiled by using approach lecturer stad more easily understood.

#### Student Learning Outcomes

Based on analysis of data above known that increase level ketuntasan learning klasikal of 68,6 % in cycles i into 82,9 % in cycles ii, then increased to 91,4 % in posttest. Increasing ketuntasan learn in klasikal from the cycle i to cycle ii due for about evaluation cycle ii arranged based on worksheet student who has discussed joint between faculty and students. While repair ketuntasan class on cycle II caused by allocation time given adapted to complexity difference. Meanwhile, the rising ketuntasan klasikal from the cycle ii to posttest much caused by posttest given on another day after cycle II ended. Allowing students to learn lessons before.

## CONCLUSION

Based on analysis of data derived from observation management of learning, activity students, response students, and study result of the students, then inconclusive some things as follows: (1) the application of learning direct and cooperative type stad in college course economic theory makro, especially on any material demand and a supply aggregate in general can way it planned. Several problems there repairable in the next round. Besides this approach can improve activity student. (2) study result of the on any material demand and a supply increased productivity of 68,6 % in cycles i into 82,9 % in cycles ii, then increased to 91,4 % in posttest. (3) response against the implementation of students learning direct and stad in college course macro economic theory appertain positive.

## References

- Amstrong, Scoot. 2008. Student Team Achievement Divisions (STAD) in a Twelfth Grade Classroom: Effect on Student Achievement and Attitude. (Jurnal Kansas State University College Education, Vol.04.29.08)
- Arends, Richard I. 1997. Classroom Instruruction and Management, New York : The McGraw – Hill Companies, Inc
- \_\_\_\_\_. 2001. Learning to Teach. Singapore: Mc Graw Hill Companies, Inc.
- Basri, Teuku Hasan. 2003. Pengembangan Perangkat Pembelajaran Melalui Media VCD Berorientasi Model Direct Instruction Untuk Menuntaskan Hasil Belajar Mahasiswa Pada Fisika Dasar II. Media Pendidikan Dan Ilmu Pengetahuan. 26 (4)
- Cagne, Robert, M., 1985, The Condition of Learning and Theory of Instruction, New York: Holt Sauders International
- Gredler, Margaret, R and Bell. 1986. Belajar dan Membelajarkan (diterjemahkan oleh Munandi, 1994). Jakarta : Raja Grafindo Persada.
- Hiro, Syamsudin. \_\_\_\_\_. Fakultas Keguruan dan Ilmu Pendidikan Unidayan Bau-bau; Studi Perbandingan Hasil Relajar Siswa Yang Diajar Dengan Model Pembelajaran Langsung Dengan Model Pembelajaran Convencional Pada Pokok Bahasan Sistem Pencernaan Pada Manusia Siswa kelas VIII SMP N 4 Bau-bau, ([http://www.unidayan.ac.id/files/SYAMSUDIN\\_HIRO\\_STUDI\\_PERBANDINGAN\\_HASIL\\_BELAJAR\\_SISWA\\_YANG\\_DIAJAR.pdf](http://www.unidayan.ac.id/files/SYAMSUDIN_HIRO_STUDI_PERBANDINGAN_HASIL_BELAJAR_SISWA_YANG_DIAJAR.pdf) f,)

- Ibrahim, Muslimin, dkk. 2005, Pembelajaran Kooperatif, Unesa, University Press, Surabaya
- Nurchasanah, dkk. 2004. Penerapan Model Pembelajaran Kooperatif STAD Sebagai Upaya Memaksimalkan Implementasi KBK 2004 Pada Mata Pelajaran Kimia di Kelas X SMA N Semarang. (Jurnal FMIPA, UNNES, Vol. 8)
- Pawarta, I Gusti Lanang Agung. \_\_\_\_\_. Jurnal Penelitian dan Pengembangan Pendidikan 2 (1), halaman 35-52: Penerapan Model Pembelajaran langsung Berbantuan Media VCD Untuk Meningkatkan Aktivitas Belajar Mahasiswa Pada Perkuliahan Atletik I". ([http://www.freewebs.com/santyasa/Lemlit/PDF\\_Files/PENDIDIKAN/AGUSTUS\\_2007/IGLA\\_Pawarta.pdf](http://www.freewebs.com/santyasa/Lemlit/PDF_Files/PENDIDIKAN/AGUSTUS_2007/IGLA_Pawarta.pdf))
- Peni, Sri. Oktober 2008. Jurnal Pendidikan Ekonomi Vol. 1, No. 2: Peningkatan Hasil Belajar Siswa Materi Bank Syariah Dengan Menggunakan Model Pembelajaran Kooperatif Tipe STAD. Surabaya: Jurusan Pendidikan Ekonomi – Unesa.
- Ratumanan, Gerson, Tanwey, 2004, Belajar dan Pembelajaran, Unesa, University Press, Surabaya
- Slavin, Robert E., 1994, Educational Psychology: Theory and Practice, Fourth Edition, Massachusetts: allyn and Bacon Publishers.
- Soejoto, Ady, dan Hariati. 2001. Model Pembelajaran Langsung Pada Mata Kuliah Statistik Pada Program Pendidikan Ekonomi 2000. Surabaya:Lemlit Unesa
- Subagyo, Lambang, dkk. 2007. Model Pembelajaran Kooperatif Dalam Meningkatkan Motivasi Partisipasi, dan Kualitas Hasil Belajar Siswa SMA N 2 Samarinda (Jurnal Didaktika, Vol. 8 Januari No. 1)
- Suprayekti, dkk. 2006. Strategi Penyampaian Pembelajaran Kooperatif. (Jurnal Pendidikan Penabur, No.7/Th. V/Desember 2006)
- Syam, Jonni. 1995. Meningkatkan Hasil Belajar Pengetahuan Dasar Teknologi Melalui Pembelajaran kooperatif Dengan Pendekatan STAD di SMK. (Jurnal SMKN 2 Somba Opu, Gowa, Vol.2)
- Trianto, 2007, Model-model Pembelajaran Inovatif Berorientasi Konstruktivistik, Prestasi Pustaka, Jakarta
- Woolfolk, Anita E., 1993. Educational Psychology. Boston : Allyn & Bacon.
- Zakaria, Effandi dan Ikhsan, Zanaton. 2006. Promoting cooperating Learning Science and Mathematics Education: a Malaysian Perspective (Jurnal Selangor University kebangsaan Press).



## EFL TEACHERS AND DIGITAL TEACHING MEDIA

**Suwartono**

Muhammadiyah University of Purwokerto

**Asfi Aniuranti**

Gajah Mada State University of Yogyakarta

### **Abstract**

*Over the past decade, along with the rapid growing information communication technology, information processing has become an indispensable part of application in varying fields. In relation to language teaching and learning, digital media have entered the classroom. Sadly, to the writer's observation when giving professional trainings, those teachers of English who belonged to 'well prepared' for this sort of media were very few. These teachers used a laptop with certain learning materials prepared prior to teaching and an LCD projector and/or speakers on the desk. In general, their teaching and learning seemed more interesting due to technology touch. They created an image of being creative, and above all, innovative. This paper presentation discuss how technology, in this case digital teaching media, supports teaching and learning; then, outlines the problems facing EFL teachers; and, finally, suggests possible solutions to the problems. Obviously, this paper presentation is meant to promote professional teaching and contribute to future researches on similar topic.*

### **INTRODUCTION**

In traditional mode of teaching, including the teaching of English as a foreign language in Indonesia, teachers used to be a source of everything in the classroom, while students were only the recipients. Teachers were the center, while students were the silent, passive objects. This concept has changed today: students are the center of teaching and learning process. Teachers with all their efforts and main roles as the classroom director, manager, counselor, and a model in the use of the language they teach, facilitate learning inside the classroom and, possibly extended to, outside formal learning context.

Today, every teacher of English in Indonesia is demanded to teach English with the 'student-centered' concept. Every teacher is given responsibilities to achieve teaching and learning goals by involving students in the process of learning the language. The change of the teaching

and learning process concept is partly influenced by the development of human life, especially the development of technology in the modern life.

The development of technology has entered the classroom. The presence of technology in the classroom is represented by the teaching media, from simple to the sophisticated forms as commonly available in language laboratories and computer-assisted language learning centers. The media are there to support the teaching and learning. This paper aims to discuss how teaching media help teachers and students in teaching and learning process, outlines problems encountered by teachers, and, finally, suggests possible solutions to the problems.

### **DISCUSSION**

#### **A. Advantages of Digital Teaching Media Use**

According to Kemp and Dayton (1985) the use of media in teaching is beneficial in the following ways:

1. Uniformity of presenting learning materials. Teachers may vary in understanding a concept. With media their various interpretations are reduced, and therefore, the messages are conveyed uniformly.
2. More interesting learning process. Media help convey audible information (audio) and visible (visual), in such a way that they are able to describe principles, concepts, process and procedures abstract and incomplete to more concrete and complete.
3. More interactive learning process. If accurately selected and well-prepared, media can help teachers and students communicate in two ways actively. Without media, teachers may tend to speak 'one way' to the students.
4. Reduced teaching and learning time allotment. Quite often, teachers need much time explaining the learning materials. When done correctly, the use of media save time. This means students may spend more time doing exercises and varied learning tasks.
5. Improved student learning quality. The use of media does not only make learning process

- more efficient, but also help students absorb or master learning material more comprehensively.
6. Student's less dependence on teacher. It is another way to say media "talk". When planned carefully, media enable learning process to occur anywhere and any time the students want, with little or no help from and even in the absence of teacher.
  7. Optimized positive attitude towards learning process. The use of media that is interesting to students will in turn enhance student's favor/love of and appreciation for knowledge and skill given and its inquiry.
  8. Teacher's wider roles. Through media, teachers do not have to repeat explanation again and again. They can save their time giving oral explanation. Consequently, they have time paying more attention to students, encouraging them, giving help, etc.

Media as teaching aids should be utilized by teachers in their teaching and learning process, but in fact this aspect is often neglected for some reasons, such as limited time for teaching preparation, difficulty finding suitable media, no funding, etc. These are all not necessary, since actually many sorts of media will do in accordance with certain conditions and needs, such as time, financial support, and material to be taught. A certain kind of media have certain characteristics and capacity in conveying messages and information (Kemp and Dayton, 1985).

Teachers should know the characteristics and capacity of each type of media in order that they can select which one best suits the condition and need. Audio CDs, for example, are good to let students have adequate experience of verbal learning materials (sounds and pronunciation).

Some audio CDs are available on the market. When the available audio materials are not suitable, teachers can prepare one by themselves with a simple way and relatively low cost. Audio media making for a classroom use just needs a recorder and a better speaker of English, that might be the teacher him/herself. The key word is creativity.

Talking about creativity in teaching and learning, the writer had most difficult moments trying to persuade his audiences that media would make their practice much better. In his professional experience of giving trainings to EFL teachers of Junior and Senior High Schools in some areas, the writer found that the vast majority of the teachers have not seemed to show interest in utilizing any kind of media. They preferred talking in most of the time, leaving an impression of monotonous

teaching and learning process. In other words, today's English language classrooms are filled with activities referring to deductive teaching.

Creativity in the use of technology in the language classroom has resulted in teaching innovations. Digital (video/photo) camera, laptop, computer, and LCD projector are often seen available in the classrooms. A good teacher of English might download songs, games, texts, images, or other materials from the internet, integrate them to those media/tools above, and use them to support his/her teaching and learning. The internet is an unlimited source of downloadable materials. From You-Tube, for example, video files can be downloaded and made use for a speaking class. From inside a laptop, Power-Point perhaps remains the most popular among those few teachers skilled in dealing with the media.

The use of media in ESL/EFL language classrooms is "the wind of change" – as a form of teaching innovation. According to Hassel and Hassel, digital media have potential to transform teaching process through three ways.

### **1. Enabling excellent teachers to reach more students.**

Great teachers will increasingly be able to teach more students in person as digital learning replaces portions of instruction in an individualized fashion and provides time-saving student data; reach students remotely via technology; and capture and share their performances and methods widely through video and smart software that individualizes learning. Even among excellent teachers, various people will thrive in different roles.

### **2. Attracting and retaining more of these excellent teachers.**

As excellent teachers reach more students, they will be able to earn more out of regular per-pupil funds. The combination of higher pay and career opportunities made possible by digital learning will, in turn, help teaching attract and keep the best performers.

### **3. Boosting effectiveness and job options for average teachers.**

Average teachers will benefit as digital technology and the extended reach of their excellent peers take complex tasks off their to-do lists, enabling them to focus on the parts of teaching at which they can excel. Through technology, they can also obtain real-time data and advice about how to help each of their students succeed, saving time and improving performance. Digital learning makes it easier to personalize instruction, which many average teachers find it difficult or impossible to achieve with whole classrooms of students with a

wide array of needs. Some new roles will pay less, but many will also require hours far shorter than today's typical fifty-hour teacher workweek.

The development of digital teaching media need teachers of English to always adapt themselves to be technologically literate and work with media to support their teaching and learning process, of course if they are committed to professionalism.

### **B. EFL Teachers in Digital Era**

Teachers as an important element in teaching and learning process cannot avoid the influence of digital era which has already created technologies. A digital age has opened up the new dimensions to the learning which are not visible in our existing traditional school system. Twenty first century learning is more complex than ever before as it includes various skills that must be acquired by the learner.

Besides creating a more complex teaching and learning process, digital era influences the teachers' role. Teachers are demanded to play their roles as a facilitator, manager, and advisor by keeping with the development of technology in digital era. Based on the article untitled *Teaching and Learning in the Digital Age*, the main roles of teachers are building linkages between their students' individual interests and understandings and the common skills and knowledge society expects them to acquire. It is the task of teachers to tackle with the technology and to grow their learners to acquire "skills of the 21<sup>st</sup> century".

In reality, on the contrary, many teachers of English seem unaware of "conventional" teaching media, let alone digital media. In the classroom, during peer-teaching training of the teacher professional certification program, where the training participants had been provided feedback on teaching performance, they did not seem to care about the comment given, highlighting the absence of teaching media. Though digital technological devices were already made available in the room, namely laptop and LCD projector, they remained relatively the same as in the second day peer-teaching.

Surprisingly, when asked if the presence of technologies in the classroom would be beneficial to students, almost all teachers' response fell into the favorable side of the scale (Suwartono, 2009). This means there is no consistency between the teachers' perception and their behavior. This could mean they only pretended: they were not honest in giving response to the survey. It could also mean

they had inadequate computer skill (or not at all), and consequently, they were not self-confident.

In his career development, the writer has some experience in using technology in the classroom. Once, he was so keen on utilizing video to stimulate student learning interest in a listening class. It turned out that video was an extraordinary medium to help language learners listen and speak. Later, he conducted a classroom action research study involving the use of internet materials to develop the students' scientific writing performance (Suwartono, 2008). Last year, he conducted another classroom research study on the use of video as a reflective tool in the English suprasegmental features teaching and learning. The study has also led to some promising pedagogical implications for the teaching of pronunciation in specific and the English language in general.

We cannot deny that students who live in digital era are more knowledgeable about technology than their teachers who just know about it recently. As pointed out in *Teaching and Learning in the Digital Age*, students are ahead of their teachers in using the technology and accessing information in various fields. They are less dependent on teachers and prescribed text books. They build upon their existing knowledge and derive their own meanings. It has provided them freedom and flexibility which was not available earlier. Learners have active, reflective role in this digital age.

Today's children are "growing up digital." Their view of the world is very different from that of adults, thanks to exceptional access to information, people, and ideas across highly interactive media. Today's children are the latest model of human being. Looking at the world of children is not looking backward at our own past – it is looking ahead. They are our evolutionary future.

In the meanwhile, the technology that develops in digital era helps teachers do their job better. For instance, in old time, teachers used to use blackboard and chalk to explain the material. Those teaching aids can be replaced by Power-Point, which is more effective and efficient for delivering the material.

Even though there are positive effects that emerge from technology, problems may also arise. The biggest one, according to an article untitled *Teaching and Learning in the Digital Age*, is a classroom filled with digitally literate students being taught by linear-thinking, technologically obstructed teachers. Students have been exposed to these technologies or similar ones early on during

their formative years while their teachers have just been exposed to it only recently. As a result, the students are sometimes more capable with the technology.

Some schools today were equipped with digital media. However, it seems only few teachers use them in the classroom. The germane question is: are they rarely given the chance to learn how to use this technology, or do they not have interest in the technology? Answer to either question means that the teachers are left behind in term of digital media, at least the ones applicable to classroom use. If it is true, then, these teachers of English do not optimally benefit students.

### C. Suggested Solutions

Here are alternative solutions to the problems faced by the EFL teachers in keeping pace with technological advancements in the classroom. The solutions are proposed considering the aspect of empowerment rather than the assistance from authorities, which means dependence and uncertainty.

#### 1. Being Actively Involved in Teaching Professional Association

The local association of teachers of English is strategic to improve the EFL teachers' teaching competency and quality. Within the organization, teachers of English can create environment for their own professional development. They cannot only share ideas, knowledge, skills, and experience among themselves, but also initiate preferred sources of up-dated information, eg. journals, and source persons or trainers with their own funding.

Observation shows most teachers are unfamiliar with scientific journal. Few teachers have adequate insights into the methodology of teaching because they have got the chance to attend very much top-down or centralized trainings by the government. It is a problem to be done in a country which is geographically and demographically very large.

The associations can actively participate in trainings held by the local government board or within university-based services. For example, in regard to teacher professional development, in China, Yang (2008) mentions the merit of a digital training system developed by the project for the teaching of writing in English in an area. The result is that it opens a fruitful way to professional teaching, efficient learning, and innovative writing. So far, trainings on teaching media for teachers of English have been very, very rare, at least in our local area and the vicinity. The association can then

initiate close cooperation with teacher training and professional development institutions nearby.

#### 2. Doing a Classroom Action Research

A study aimed to improve the professional skills of teachers through a change of mindset (Sukarni, *et. al*, 2009) concluded that the EFL teachers involved in the classroom action research program were encouraged to enhance their competency level, believe in their own capacity in the English language competence, and were willing to cooperate with issues such as the importance of IT facilities for the improvement of education, were eager to attend international seminars, publish the paper in seminar proceedings, and in an international journal. It means that EFL teachers are ready to improve their own practice, including the use of technology in the classroom by learning and working together with colleagues.

Teachers more capable in digital teaching media can share knowledge and experience with their peers in collaborative action research projects. That is why, Burns (2007) asserts that action research is "...a way of empowering teachers – especially when it is used collaboratively to share ideas and explore classroom issues with colleagues." It can be said that it is a kind of an implicit – learning by doing – approach to teachers' professional development.

### CONCLUSION

Technological advancements in varying fields of life have entered the language classroom. EFL teachers should warmly welcome the technology progress and optimally make use of it as medium to support their teaching and learning, of course if they are committed to professionalism. Therefore, they should continually sharpen their creativity by exploiting the technology for teaching innovations. Teaching Professional Association activities and collaborative classroom action research are strategic to empower EFL teachers in keeping pace with the development of today's digital technology applicable to the English language classroom. With the activities EFL teachers do not have to wait until they are too late!

### References

- Burns, Anne, "Empowering Teachers through Collaborative Action Research," *The 55th TEFLIN International Conference 2007* (Proceedings), Jakarta.
- Hatmanto, E. D., "Internet Resources for Creative Teaching Materials for ESL" (Proceedings), *The 2009 UAD TEFL National Conference*, Yogyakarta.

- Hassel, B.C and Hassel E.Y. (2nd), "Teachers in the Age of Digital Instruction", Accessed online: <http://edexcellencemedia.net/publications/2012/20120425-education-reform-for-the-digital-era/20120425-Education-Reform-for-the-Digital-Era-FINAL-Chapter-1.pdf>. 3 December, 2013 at 18.49.
- Kemp, J. E., and Dayton, D. K., *Planning and Producing Instructional Media*, Harper & Row, Limited, 1985.
- Richards, J. C., and Lockhart, C., *Reflective Teaching in Second Language Classrooms*, Cambridge: Cambridge University Press, 1996.
- Sukarni, E. I., Winarni, D., and Nirmayanti, Y. T., "Improving Teachers' Professionalism through Materials Development, Information Technology, and Classroom Action Research," *TEFLIN Journal*, Volume 20, Number 2, 2009.
- Suwartono, "Dependent upon Teacher's Creativity" (Proceedings), *The 2008 GloCALL International Conference*, Yogyakarta, Indonesia.
- Suwartono, "The Necessity of Synchronizing the EFL Teachers' Perception with Their Behavior to Upgrade Professionalism"(Proceedings), *The 2009 TEFLIN Conference*, Malang, East Java, Indonesia.
- Teaching And Learning In The Digital Age Education Essay*, Accessed online:<http://www.ukessays.com/essays/education/teaching-and-learning-in-the-digital-age-education-essay.php>. December 1, 2013 at 16.39.
- Yang, Yonglin, "Digitalization in ELT Classroom: An Enjoyable Path to Innovative Teaching and Learning" (Proceedings), *The 6th Asia TEFL International Conference*, Bali, Indonesia, 2008.

## DEVELOPING A COMPREHENSION BASED INTERACTIVE READING MODEL

Pudiyono

Muhammadiyah University of Purwokerto

### **Abstract**

*The goal of the research was to develop interactive comprehension based reading model to develop the students' comprehension skills which were integrative with the other language skills; listening, writing and speaking. To reach the goal, this research in the first year was oriented to invent the following: 1) teaching and learning strategy in reading, 2) student's learning strategy, 3) text books and other resources for the students' reading materials, 4) students' interests in reading, 5) students' attitude towards reading instructions, and 6) hypothetically, finding the basic model of interactive comprehension based reading model.*

*The subjects of the research were teachers and students of SMA Negeri 1, 2, 3, 4 and 5 of Purwokerto. Data collections were done through questionnaire, observation, interview and documentary. These then were analyzed using qualitative model of Huberman, while the quantitative was done through percentage.*

*Data analysis results showed that majority (>80%) reading strategies applied still focused on rhetoric approach; generic structures, language functions, etc. The reading instructions did not focus on the comprehension. Besides, the teachers did not apply cooperative nor collaborative learning strategies. Reading aloud and translation activities which do not encourage comprehension were still much applied. The score of reading strategy was still under the expectation. Most schools used LKS for their learning resources. Therefore, the student's interest was just 68.18 and the student's reading attitude was even worse with only 57.21. To solve this problem, the teacher should create cooperative and collaborative learning activities to make students interact well. To develop comprehension, the teacher should apply scientific approach in which the text was considered as the data and realize the results of their understanding into graphic organizers.*

**Keywords:** instructions, reading text, interactive activities, comprehension, reading skills, graphic organizers

### **BACKGROUND**

Reading skill is the most basic language skill which students have to master. This language skill is obviously considered strategic as having good reading skills, students do not only achieve the information they seek to develop their life quality, but they could certainly develop other language skills well.

Most SMA students in each level showed low reading ability. This in turns brought about problems in their mastering English on both oral and written language. Reading comprehension had been the most basic problems they deal in their learning. This basic comprehension problem covered problems in understanding new vocabulary, new phrases, sentences, paragraphs and the whole passage.

Presumably, student's understanding on vocabulary was too low to understand the phrases and sentences they encounter in reading. They usually comprehended words or new words in a reading text as what they read them in a dictionary. This might cause problems for students to get the correct meaning in longer language forms. The problems in understanding words might lead them to have problems on sentences, paragraphs. In short, students might fail to understand the reading task as a whole.

Many factors contributed these problems. The teaching learning procedure did not really push the students to work contextually interactive in developing reading skills. This inappropriate measure of handling reading classes did not really encourage students to develop activities needed to develop their real life skills. Unfortunately, this common practice had been going on since they started their reading instruction in earlier level or Junior High School level.

Reading instructions in both Junior and Senior High Schools generally much focused on explaining text forms which was just rhetorical and quite inappropriate with the life skill they needed to develop. Some examples dealing with this were explanations on generic structures, language features, social functions, etc. which were considered to have no practical benefits to the life skills needed.

Reading instructions in both SMP and SMA focused so much on rhetorical explanations such as generic structures, language features etc. that these instructions did not explore activities on comprehension. In fact, comprehension was the core factor in reading instruction. As we have in our daily lives, we have no businesses at all in reading, except to get the comprehension. Therefore, as the basis in reading activities, every teacher who has to teach reading must know this and varies exercises to students to explore comprehension on the reading text students read.

Besides that, there were still many other exercises implemented in teaching and learning reading activities which deviated much from the comprehension core content for students. Those exercises covered reading aloud, translation, and asking students to open up a dictionary when finding a difficult word. These activities did really have less contribution on developing students' reading comprehension. They did not even have any support to make students become independent readers which should be encouraged to develop as their daily life skills.

Based on this background, it is highly recommended to have an appropriate solution which could shape and change both teachers and students' mind-set in teaching and learning reading to solve this problem. This teaching and learning reading should be interactive reading activities which develop students' participations in pre-reading, whiles reading and post-reading activities which is based on comprehending the passage or *reading texts* being learnt.

## METHOD

The design of this research was a qualitative and quantitative one. The research was to get factual description on the reading teaching and learning model and the strategy being implemented currently in those school settings. The research was considered as the preliminary research which aimed at: 1) noting TL reading strategy, 2) noting students' learning strategy in reading classes, 3) noting resources and text books as their reading materials, 4) noting students' interest in learning reading, 5) noting students' attitudes towards reading instructions and, 6) hypothetically, deciding the basic patterns of reading instruction on comprehension based interactive reading to develop the students' comprehension skills. Collecting data was done from February up to August 2013, the population in this research covered all teachers and students from 5 SMA in Purwokerto; SMA Negeri 1, 2, 3, 4 and 5 in the academic year 2013-2014.

Data collecting technique was done through: 1) Questionnaire was carried out to get information data on students' attitude, motivation, and students' feelings in joining reading instructions. The answer of the questionnaire was converted into scales or scores as the following; quite agree= 4, agree= 3, disagree= 2 and disagree much= 1.2) Observation was applied to get data on how far comprehension based interactive reading had been accomplished. In applying the observation, the observers used observation sheet, check list and notes, to minute the application of comprehension based interactive reading activities happening in the class. The observation sheet was designed containing behaviour items or happenings which would likely be to happen. 3) The interviews were done especially to the English teachers to get data on reading resources, reading text materials, students' attitudes towards reading classes, students' learning strategy on reading, teachers' strategy in implementing teaching strategy. 4) This research also applied documentary by analyzing the teachers' documents on learning instructions such as lesson plans to get their learning strategy, materials, reading sources.

Analyzing the data dealing with questionnaires on reading sources, students' attitude and motivation applied percentage. By using percentage analysis, the trend or counter trend of the aspects in points such as students' motivation and attitudes would come out. Other type of data belonging to qualitative ones were observed and analyzed using qualitative data analysis such as observe and note or *simak* and *catat* by referring to the frequency of the distributions.

## RESULT AND DISCUSSION

### 1. The Strategy Applied in Reading Instructions

a. The interviews on teaching and learning strategies were carried out to in those schools in friendly and less formal atmospheres. Commonly, they responded happily to this activity as they could also have the chance to share their experience and problems they had in their professional jobs. The results of the interviews are as following:

- 1) Reading instructions still much focused on rhetorical aspects such as *generic structure*, *language feature*, *social function*, etc in their implementation of reading instructions.
- 2) Teachers did not implement on reading instructions in which teacher led students use reading text or material to analyze to come into well accepted conclusion.

- 3) Reading instructions did not apply teaching approaches which lead students to build social skills such as cooperative and collaborative learning.
  - 4) Variations of activities and creativities leading students to comprehend reading materials were still less developed.
  - 5) Many teachers applied misleading activities to develop comprehension by focusing much on grammar, games, cross-word puzzles, etc. which did not lead them to have reading life skills.
  - 6) Pre-reading activities they applied did not really stimulate the students' motivation in reading the reading materials as they mostly related little to the reading materials presented.
  - 7) Many reading instructions still applied *reading aloud* which did not really push students to get understanding.
  - 8) Exercise innovations were much needed to make students develop their reading life skills extensively.
- b. Triangulations on documents by observing lesson plan documents they used for their classroom reading instructions showed that the results really underlined the results of interviews. The documents did not really show clear learning procedures on implementing reading classes on cooperative and collaborative procedures. They did not present clear steps of activities which led students to develop their reading life skills.

## 2. Student's Learning Strategy in Reading

The survey asked 30 questions related to students' learning strategy. Overall, the result of the students' learning strategy in classroom as well as non classroom reading instructions showed that their learning strategy did not show good strategy. This was supported by the result of the questionnaire score: 66.62.

Those 30 questions derived from 6 learning strategies. Out of those 6 learning strategies, the students quite often used 3 learning strategies more to develop their reading comprehension; social, affective, and compensatory strategies. The social learning strategy, covering discussion with friends; learning in groups, got the highest score reaching 77.25 or 3.08 in scale 4. The next to social learning strategy was affective learning strategy with 75.70% or 3.04, and compensatory learning strategy with 67.00% or 2.67. The highest score of the social strategy happened as the result of the students' good cooperative among

them. Unfortunately, this social learning strategy the students accomplished mostly happened when they did activities out of the class. This result was backed up from triangulation result taken from other data analysis as telling that most schools had not run classroom reading instructions which applied cooperative and collaborative learning strategies by several reasons. Therefore, students from these schools developed group works by themselves beyond their formal school times.

Meanwhile, the other learning strategies; cognitive, metacognitive, and memory strategy were not much used by students in developing their reading skills or *comprehending English texts*. This was quite serious as the score the students got was only 60.83. This was even worse because cognitive learning strategy was considered the strategy which directly developed the students' reading skills. With this low result of cognitive learning strategy, the survey showed that students rarely accomplished the following activities in reading:

- a. Making an outline about the conclusion of the text that they read.
- b. Writing the important information taken from the text that they read.
- c. Analyzing and evaluating the information of the text critically.

## 3. Resources and Materials for Reading

The survey asked students with 48 types of typically reading resources in English found in everyday activities. The survey result showed that students did not read various English reading materials. What they usually read was just to improve their reading skills by reading student's workbooks or LKS; 86.66. Next to LKS, students seemed to have good habit of reading English cartoons and caricatures; 63.33. The third big percentage for students to do was reading English instructions 50. This was something usual for students to do when they had their English test or exercises.

The interview results taken from interviewing teachers working in those schools showed similar outcomes. The following is the results:

- a. Commonly the teacher used *ready made* English materials in the form of text books for their learning sources and material in their classroom interactions. Those text books were published by various publishers and provided by schools. Therefore, it was compulsory for students to have one as their daily reading resources.
- b. In developing students' English skills, majority of teachers used students' workbooks or LKS which were taken from different publishers. As



public knowledge, students' workbooks were printed English resources which did not have high academic quality as they were printed without passing through tight editing. Some complaints came out as the result of using this LKS. Many parents complained as saying that the LKS materials were not really suitable to students' level. Some expressions used was considered impolite (SindoNewscom, 19/09/13). Repubika (11/08/13) also issued similar outcries as telling that LKS up to now had been main resources in the learning instructions at schools. However, the LKS used at schools needed evaluation to get more effective. One of West Java Province legislators lamented that teachers should be more creative not to always use LKS as their main learning sources.

- c. Most teachers did not want to be creative to develop their creative aspect by trying to make use authentic English texts which could be taken from daily materials which students had to know to be applied and developed in their learning instructions. Such those learning materials could be taken from newspapers, magazines, announcements, short stories, manuals, game instructions, catalogues, diaries, diagrams, reviews in English et cetera.

#### 4. Student's Interest in Reading

Students' interests consisted of three major components covering personal interest, teacher's support, and teaching method. To get clear descriptions on students' interest in reading activities or classroom reading instructions, this research used questionnaires.

The total number of respondents was 135 students consisting of 50 male students, and 85 female ones. This number of respondents covered all students in that level. In general, the students' interest was not high enough, therefore, needed much development as the score of the questionnaire result just showed 68.18. The results of those three components are as the following:

##### a. Student's Personal Interest

Overall, the students' personal *interest* in reading just showed 68.54. This achievement did not show happy result as this was under good category which should be at least 70. However, out of 10 question items asking this aspect, six (6) showed good results. Those six covered: 1) always try to understand the content of the text they read (3.99), 2) often respond teachers' questions during class sessions (3.84), 3) feeling happy learning reading in English (3.79), 4) feeling interested in reading English

when seeing English books (3.77), 5) considering that English books are important (3.69), 6) always trying to be active in class sessions.

Three other question items showed fair results which covered: 1) feeling happy doing exercises in English classes (3.31), 2) always try to answer teacher's questions in reading classes (3.15), 3) always try to guess the meaning of unfamiliar words (2.82).

One question item, go to the library to read or get reading materials/passage, fell into bad one with score 2.48.

##### b. Teacher's Support

In general, the results of teacher's support for students in learning reading reached score 66. This score was considered less good than the score found in the student's interests. This means that the role of the teachers in the classroom reading interaction did not get much appreciation from the students. Anyhow, the ten question items asking this aspect explained that three achieved good results, with the following details: 1) discussing with the teacher during reading class (3.83), 2) fond of seeing the teacher's appearance (3.73), 3) give rewards or appreciations to students (3.62).

Five question items showed fair results which covered the following: 1) the teacher gave time to students to respond, 2) the teacher encouraged students in solving problems, 3) the teacher gave much attention to the class, 4) the teacher let students express their problems, 5) the teacher had willing to help. This means that the teacher was quite responsive only dealing with direct skills of handling classes on reading presentation. When it dealt with problems, two question items showed bad results as 1) the care on students having bad English achievements, and 2) the care on students being quiet on having problems.

##### c. Teaching Method

Overall *teaching method* aspect in learning reading comprehension for students reached 70.02. This means that students appreciated well the way the teacher presented reading instructions for students. The good responds on question items for the teacher in presenting the reading instructions covered: 1) the way the teacher explained the explanations, 2) the explanations given presented in humorous modes, and the text variations. Another important question item which had low responds from students was on group works. It seemed that the teacher did not build the good

habits of running group discussions. This was also obvious in another data result. Discussions among students happened out of classroom learning.

The fair responds of question items covered: 1) reading with media, instructions in full English, 2) LKS based instructions and 3) students having English questions from teachers.

## 5. Student's Attitude towards Reading Instructions

### a. General Responds

Student's attitude in reading instructions could be classified into two main classifications. Those were students' attitude towards the objects and *the attitude towards the aspects*. The students' *attitude towards objects* consisted of three sub components covering: a) attitude towards material, b) attitude towards process of learning, and c) attitude towards teacher. While the students' *attitude towards the aspects* also consisted of three sub components which covered: a) cognitive aspect, b) affective aspect, and c) behavioural aspect.

In general the result of students' attitudes in following classroom reading instructions were categorized as not good enough, as the score average on the questionnaire only showed 57.21. This figure just showed that student's attitudes towards classroom reading instructions needed much attention and development in order to get good results as expected. The efforts needed to develop the students' attitude had to include the object aspects, covering learning materials, learning procedures, teachers, internal and external motivations of the students and related parties.

### b. Responds in Each of Attitude Object

The student's attitude in classroom reading interactions on attitude object basically did not show good result, just 57.13. This means that majority of students did not have an appropriate appreciation or respect on the classroom reading instructions, even though the questionnaire score towards their teacher showed the highest score 59.26. This was not considered appropriate to produce good impacts towards their reading achievement.

The students' attitude on the classroom reading instructions did not give different result from that of the attitude object. Fortunately, students showed cognitive aspects as the highest. This was good as this could be the indicator that students paid more attention on the cognitive aspect even though this was not

good enough to create agreeable situation in learning as the score 62.13. The following is the complete table of the students' attitude:

### c. Question Item Results

The student's attitude on classroom reading interactions from the questionnaire in detail showed that four aspects had good achievements. This also showed that these four belonged to students' individual or personal basis on student's inner attitude which was not much influenced by external factors. Those four question items (achieving more than 70) covered: looking for reading text books, reading English materials, discussing with friends and learning materials by themselves at home. On the other hand, other students' attitudes in reading activities showed low results. This included; doing exercises, feeling challenged to find problems when learning atext, feeling happy with teacher's rewards, following teacher's instructions on reading, feeling happy to join English classes on reading, feeling happy with the teacher, interesting reading method, working together in doing tasks, with all under 50.

### d. Teachers' observations

The students' attitude towards English reading instructions was taken from the interview results with teachers in the schools. The following absorbs were the results:

- 1) Most students did not like much joining reading classes compared to those other skills such as speaking and listening.
- 2) They thought that reading English texts was a big job, not just an ordinary activity like others.
- 3) Teachers mostly used LKS for their reading skills and material in their instructions.
- 4) Teachers did not use IT media as most schools did not supply this media technology and besides to use this kind of media needed more time or even time consuming.
- 5) The learning strategy did not apply or develop social networking skills by applying both cooperative and collaborative strategies, for example by group works, pair works, etc.
- 6) Student skills in doing reading skills needed developments.
- 7) Students mostly felt bored in the classroom. It was obvious that some got asleep and talked to their friends.
- 8) Only some students used library for their study.

## 6. Developing a Comprehension Based Interactive Reading Model

### a. The Concept of a Comprehension Based Interactive Reading Model

#### 1) Interactive Reading Activities

The implementation of reading activities which involved a lot of participants in the class room reading based on the application of cooperative and collaborative learning strategies. With these models, students may have lots of activities such as sharing, discussion, mutual helps, both in pair works, small group works or teams. These activities were developed to encourage social cooperative among students in their groups or as a whole. These kinds of activities are quite significant for students to do to build their social spirits as their life skills they have to develop. These interactive reading activities would bring about good results by applying the following key activities:

- a) Cooperative learning activities
- b) Collaborative learning activities
- c) Share, discuss, report, inform, describe.
- d) Work in pairs, in small groups, in teams.

#### 2) Comprehension Based Activities

The appropriate reading activities should be based on reading comprehension. That someone has to do a reading activity is encouraged by the fact that he has some reasons or knowledge or information gap. To get good reading comprehension of the text, readers have to supply themselves with questions. The more questions one has in reading, the better understanding he has on the text he is reading. The first question could start from the title he first reads. From the title he should have a question or two considered as hypothetical questions. The next step for him to is to link the questions to the text by trying to find out the answers of that question offered in the reading passage.

Readers could come across new vocabulary on the text material they read which present problems to them. Experienced readers would then be able to solve such problems easily by observing the textual contexts, building prior knowledge and then making some guesses of meaning contextually to the passage. The main and central step in comprehending the meaning of the text is that the reader should be able to

design a comprehension map clearly, either in an abstract concept or writing draft on a piece of paper. By being able to make such a comprehension map, the reader would then be able to achieve the meaning or message or information presented in the reading passage. Therefore, the following are the key activities people use to build good comprehension.

- a) Observe the title, texts, data, and premises.
- b) Make hypothetical questions based on the title.
- c) Understand new vocabulary found in the text based on its context.
- d) Identify the answer to the hypothetical questions.
- e) Understand the content by making the point graphs or graphic organizations.
- f) Make the summary

### b. The Implementation of Comprehension Based Interactive Reading

#### 1) Pre-reading Activity: in pairs or small groups

Pre-reading activities were good initial learning which encouraged acceptable learning conditions for students to get the subject or topics well. Having well prepared pre-reading activities would make students much focused on the reading passage they had to undergo. Teachers could initiate class in pre-reading by presenting questions, or light exercises, or even games to arouse students' motivation. Teachers should be able to encourage students' motivation by pushing students to build their *prior knowledge, make predictions, establish a purpose, generate questions* and finally students were really serious and focused in trying to get the answers by reading the passage or text.

This activity was good to run for about 10 minutes, because this kind of activity was meant as the *warming up*. Therefore, within one instructional meeting it was enough to have one pre-reading activity. The following are some optional key expressions to do pre-reading activity.

- a) Ask general questions leading to the text.
- b) Make students do light exercises leading to the text.
- c) Make then finish point graphs leading to the text.

2) While Reading Activity: in pairs or small groups

By focusing the text title carefully, students should be able to make one or two hypothetical questions stemmed from the title. The hypothetical questions which students had to make should by then be able to encourage them to read the reading text further carefully and smartly in order to get the answer. This might be in the form of activities in answering questions they formulated earlier during pre-reading as well as others that could arise through their reading activities.

The next procedure was to deal with identifying unfamiliar words or new vocabulary they could possibly come across. Good and experienced readers should be able to solve those unfamiliar words by guessing the meaning or synonymous words based on the phrasal and sentential and paragraphed contexts. By digesting the context smartly, students did not have to make them busy and bothered consulting to a dictionary. Students were not then recommended to use a dictionary as this would only make them to dependent readers who could not read well and fluently.

Having had the unfamiliar words solved, the students then try their best to analyze the content of the passage by identifying the main points found in the text. The next step was to make notes on those main ideas or concepts and then design the content graph or graphic organizations either in abstract pictures or in real crosses they could make on a piece of paper. The following is the standard procedure of activities in while reading.

- a) Observe the title.
- b) Make hypothetic questions based on the title.
- c) Solve new vocabulary problems in context to the text.
- d) Identify the topics of the paragraphs.
- e) Identify the core content of the text.
- f) Design the graphic organizers.
- g) Make a summary.

3) Post Reading Activity: in pairs or small groups

Still in pair or small group activities, this post reading activities were meant to encourage students to design follow-up activities relating to the information taken in the text. This was recommended as to make

the information and message taken from the text implanted into their knowledge which could enrich their life skills. The recommended activities could be as the following:

- a) Discuss related topics
- b) Write related topics

## CONCLUSION

The conclusions taken from these data analysis are of the following:

- a. The classroom reading instructions still applied rhetorical explanations which did not support the comprehension as the core content; generic structure, language features, social function of texts, etc.
- b. The classroom reading instructions still applied misleading activities such as reading aloud, translation activities, which did not really support students' goal in developing comprehension.
- c. The development of social life skills in the forms of cooperative and collaborative learning strategies was not yet developed.
- d. Students' reading strategy needed development as the score was still low 66.62.
- e. Reading resources and reading materials needed variations which related to contextual life. Teachers mostly used workbooks published locally (86.66%) for students to learn. This did not give wide reading exposures to students.
- f. Students' motivation on reading needed much encouragement as the score was only 68.18. On the hand, the students' attitudes towards reading were still in dire level as the score only showed 57.21.
- g. The solution to the problem of classroom reading instruction was to apply cooperative and collaborative learning so that interactive reading could be realized.
- h. The most important step to implement this classroom reading instructions was to apply comprehension based reading using scientific approach. Reading texts were treated as data by which student could further implement scientific approach by designing graphic organizers to show their understanding on the reading materials they have already read.

## References

- Arikunto, Suharsimi. (1998). *Prosedur Penelitian*. Jakarta: Rineka Cipta
- Ball, Christopher. (1971). *Lexis: The Vocabulary of English. The English Language*. Great Britain: Sphere Book Ltd.

- Emerald, Dechant. 1991. *Teachers Directory of Reading Shells Aids and Materials*. New York: Parker Publishing Company, Inc.
- Ending Kusriani, (2012). *Interactive Activities as An Alternative to Encourage Students' Involvement*. EDUCARE; Volume 4 Number 2
- Evans, Desmond, W. 1990. *Improving English Skills*. Dina Rupa Aksara. Jakarta
- Littlewood. (1999) *Communicative Approach in Language Teaching*. Great Britain: Sphere Book Ltd
- Napa, Pieter A. (1991). *Vocabulary Development Skills*. Yogyakarta: Kanisius
- Nunan, David. 1998. *Language Teaching Methodology: A Textbook for Teacher*. UK Prentice Hall International Ltd.
- Tarigan, Guntur Henry. (1985). *Pengajaran Kosakata*. Bandung: Angkasa.
- Wilkins, D. A.1983. *Linguistics in Language Teaching*. Edward Arnold Ltd., London.

## DEVELOPMENT OF EXPERTISE COMPETENCY BASED PHYSICS PRACTICAL WORK ON THE FIELD OF MASONRY AND CONCRETE CONSTRUCTION ENGINEERING IN VOCATIONAL HIGH SCHOOL

**Ristiana Dyah Purwandari**

Student of Science Education Doctoral Program, Indonesia University of Education,  
Indonesia

### **Abstract**

*This study was part of a research and development (R&D), aimed to develop of expertise competency based physics practical work on Masonry and Concrete Construction Engineering in Vocational High School (SMK). This study was established on several inventions in the field as prerequisite analysis, including: the result of curriculum analysis on association of adaptive and productive group science, result of written questionnaire on the adherence of physics practical work in Vocational High involving 26 physics teachers from 13 vocational schools in seven Regencies, Central Java Province, unexploited potential of local mineral materials, development of No-fines Concrete technology, vocational high school physics teachers' perceptions to the development of expertise skills competency-based physics practical work and science process skills of vocational students that were still low. The results of the study obtained initial design of expertise competency-based physics practical work development through No-fines Concrete technology.*

### **BACKGROUND**

Vocational education aims to improve intelligence, knowledge, personality, noble character, and skills of the students to live independently and to take advanced education in accordance with the vocational program (curriculum of SMKTujuh Lima 1 Purwokerto, 2009). To support these objectives then the structure curriculum of vocational school is drafted consisting of three groups of subjects namely the normative, adaptive, and productive subject. Physics subject is one of the adaptive groups underlying technology development.

Based on the improved mindset of Curriculum Formulation 2013, it is found that Graduates' Competency Standards is derived from requirements, Content Standards is derived from Graduates' Competency through free subjects-Core Competencies and all subjects should contribute to the establishment of attitudes, skills, and

knowledge, as well as the subjects derived from competence to be achieved. In addition, based on the learnedness of the 2013 curriculum, it emphasizes on: Student-Centered, Interactive, Active-Probe, Real World Context, Team -Based Learning, Stimulation in all directions (all senses), Multimedia Equipment (various educational technology equipment), Multi-Discipline Knowledge (multidisciplinary approach), and Critical (requires creative thinking).

Based on the decree of the General Director of Primary and Secondary Education Management Number:251/C/Kep/MN/2008 about spectrum of expertise on vocational education, there are six areas of study set for vocational skill. Field study of expertise includes: Technology and Engineering, Information Technology and Communication, Health, Arts-Crafts-Tourism, Agribusiness and Agro Technology (Agriculture), and Business and Management, all of which consisted of 121 skill competency. Three of the six subject areas of expertise are supported by adaptive subjects (physics) i.e. Field of Technology and Engineering expertise subject, Health and Agriculture. Each total hours of physics subject for three-year study period is 276 hours, 192 hours and 192 hours.

Giancoli (2001), states that students who have been interested in entering the fields of expertise of non-physics will ask, "Why should I study physics?" Consistent with these questions and in accordance with the basic competencies of physics subjects comprised in the vocational curriculum, the basic competencies of physics in Vocational High School is as follows : (1) Mastering the basic concepts of physics that directly support the achievement of skill program competencies, (2) Applying the basic concepts of physics to support the application of the skill program competencies in everyday life, (3) Applying the basic concepts of physics to develop skill program capabilities at a higher level. Under those conditions, the learning of physics was highly influential in the achievement of skill program, and this should be an important concern for physics teachers in Vocational High School. However, in the field, physics teachers do

not design the learning suitable to the expected competencies.

Physics learning process carried out by teachers mostly remains theoretical and less supported by lab skill activities in laboratory that can provide students in understanding concepts. Moreover, based on the research results of Memon, 2007 (in Faize, 2011), the science teachers are simply supplied with only pedagogical-theoretic aspects but less emphasis on teaching methods using lab skills. Training provision in conducting lab skills is completely disregarded; the consequence is that science teachers are lack of teaching skills using practical methods that are effectively needed in students' understanding of concepts.

Learning physics as part of science is essentially aimed at fostering students' intellectual competencies such as independent learning, problem solving, decision making and critical thinking (American Association for the Advancement of Science (AAAS), 1993; National Research Council (NRC), 1996. According to Tan & Temiz, (2003), the essential purpose of teaching science today is to educate students to be able to conduct researches, explore, investigate, make connections between everyday life with science topics, use scientific methods in solving problems and see the world through the eyes of a scientist. In order that science learning is able to give impact to the expected skill, it is essential to consider how the learning process is presented to the learner, (Utari, 2010). Considering this objective, students should try to obtain and achieve the knowledge and skills of the process, in this context, science education becomes very important (Taşdere & Ercan, 2009), in order to obtain the information, students need to develop several skills called "science process skills". Science process skills emphasized on the formation of knowledge acquiring skill, and communicate the acquisition. Skills mean the ability to use the mind, reason and action efficiently and effectively to achieve a particular outcome, including creativity. Related to this, laboratory is a proper mode for learning activities as well as providing students with science process skills.

Millar (2004, p.1) in his article on The role of practical work in the teaching and learning of science summed up broadly two main aims of science education:

- To help students gain an understanding of as much of the established body of scientific knowledge as is appropriate to their needs, interests and capacities

- To develop students' understanding of the methods by which this knowledge has been gained and our grounds for confidence in it (knowledge about science).

The first aim is about understanding the content of science and the second is about understanding the nature of science. An understanding of how science and the scientific community work will help students learn the content of science better. This includes understanding of the processes involved in the conducting of a scientific enquiry, the intellectual reasoning used by scientists to analyse data and produce evidence in order to make a claim or propose a theory, and how this evidence is verified by the scientific community.

Hodson (1990:34), suggests that activity in the laboratory has four main functions, namely: (a) to carry out the experiments (experiments), (b) laboratory work, (c) practice, and (d) the implementation of didactic science education. Practical work is defined according to Millar (2004, p.2):

*"any teaching and learning activity which involves at some point the students in observing or manipulating real objects and materials"*.

Practical work in this sense includes fieldwork, laboratory work and experimental work. In the context of our study with Vietnamese high school physics teachers, classroom teaching was the focus of our study but not fieldwork, and the wordings of 'practical work', 'laboratory work' and 'experimental work' are used interchangeably in this paper to have similar meanings in Millar's context.

Tamir (1991) has established five major rationales for school science laboratory work. These are: (i) laboratory work provides students with opportunities for understanding and manipulating the highly complex and abstract nature of science in inducing effective conceptual change, (ii) working with the actual investigations helps students develop procedural knowledge, promote problem-solving and analytical skills as well as fostering scientific attitudes and values such as honesty, patience, acknowledgment of failure, understanding experimental limitations and being.

Practical work is defined as a method of learning that serves to clarify the concept through contact with tools, materials or natural events directly, increase students' intellectual skills of through observation or complete and selective information exploration and support practical

problem solving, practice in problem solving, apply knowledge and skills to the situation faced, practice in designing experiments, interpret data, and develop scientific attitude (Departemen Pendidikan Nasional, 2007).

The problem now is how the development of the physics lab skill that is able to accommodate the needs of expertise competence and what factors underlie the development? Students are expected to have expertise competencies that are expected to be supported by lab skill activities that provide skill process. Additionally, students are exposed to real-world context that uses multidisciplinary knowledge (multidisciplinary approach), can be done in teams, and develop creative thinking.

## METHOD

This study was part of the R & D, at the initial stage analysis of necessity was performed, including the curriculum identification of vocational school (SMK Tujuh Lima 1 Purwokerto and SMK Negeri 2 Purwokerto) groups of adaptive and productive lesson, those were the subjects of physics, performance and inspection of concrete construction and building materials science engineering. This activity obtained the connection between basic physics competence and productive subjects. Research activities continued with written questionnaire about practical implementation in vocational schools involving physics teacher respondents (N = 26), namely seven Public Vocational Schools and six Private Vocational Schools in seven Regencies, Central Java province. To develop expertise competency-based physics lab materials, literature review of research results related to concrete technology and the relation of basic competencies that had been acquired earlier between basic physical competence and productive group basic competences was performed, one of the technologies being developed was the technology of no-fines concrete which was a group of lightweight concrete. In this study, also conducted written questionnaire on vocational school physics teachers' perceptions toward the development of no-fines concrete based lab skill, dig science process skills on Vocational School students of class X, and observation of local mineral potential that can be used as a test object of no-fines concrete.

The instruments used in the study were as follows: 1. written questionnaire of physics learning implementation by using lab skill method in vocational school, 2. written questionnaire about teachers' perceptions on the development of expertise competency requirement-based physics lab skill. Both instruments used contained semi-

opened questions. The instruments submitted to all the teachers had been permitted by the principals. The instruments used to measure the science process skills consisted of: 1. Practice assessment in the laboratory, 2. Science Process Skills questions with properties of concrete aggregate-based physics materials. The questions consisted of ten essay questions and four multiple choices.

## RESULT AND DISCUSSION

Based on the existing curriculum at SMK 2 and SMK Tujuh Lima 1 Purwokerto stated that physics competencies on Masonry and Concrete Construction Engineering in Vocational School were as follows : (1) Mastering the basic concepts of physics that directly supported the achievement of their expertise competency program, (2) Applying basic concepts of physics to support the application of their expertise competency program in everyday life, (3) Applying the basic concepts of physics to develop their expertise competency program at a higher level . Expertise Competency of Masonry and Concrete Construction Engineering including: a. Being able to choose a career, being able to compete and develop themselves in the scope of Building Engineering Program especially expertise competency on Masonry and Concrete Construction Engineering, b. Providing learners with knowledge and skills as a preparation for those interested in continuing higher education .

Identification of physics basic competence and basic competences of productive group (Implementation of Concrete Construction Inspection Engineering and Material Science) that had mutual relationship respectively were as follows: A. Basic physics competencies encompassed: 1. Mastering the concept of scale and its unit, 2. Using the appropriate measuring tools to measure physical quantity, 3. Mastering the concept of temperature and heat, 4. Mastering the effect of heat to a substance, 5. Measuring temperature and heat, 6. Calculating heat, 7. Calculating vibrations, waves , and sound, B. Basic competence of Masonry and Concrete Construction Engineering included : 1. Checking building materials: Identify the size of fine aggregate and coarse aggregate (gradation) to recognize the difference, Learn how to identify the quality of materials and physical natures of aggregates include: aggregate gradation, density, weight, water absorption, water content, 2. The strength of concrete and concrete properties .

Based on the analysis of vocational curriculum on the field of Masonry and Concrete Construction Engineering (between physical competence and



productive group competence) and literature review of research results related to concrete technology, expertise competency requirement-based physics lab skill materials were developed as follows : 1. Reduction of sound waves, 2. The density and weight of the aggregate, 3. The density and weight of non-sand concrete brick wall materials, 4. Thermal conductivity of non-sand concrete brick wall materials, 5. The rate of heat flow of non-sand concrete brick wall materials, 6. Temperature isolation of non-sand concrete brick wall materials.

The results of the initial survey and written questionnaire to the Vocational physics teacher in Purwokerto, they were SMK 2 and SMK Tujuh Lima Purwokerto, showed that the physics lab skill as a learning support lab had not been implemented. Observation results also indicated that many physics laboratories were not well-managed; even some practical tools such as lab kits had not been used and stored neatly. The teachers' excuses were: lack of school hours (time limited meetings, only 2x45 minutes per week) and the lack of adequate facilities and infrastructure. It was also confirmed from the results of measurements of Science Process Skills of SMK Tujuh Lima Purwokerto students.

Science process skills measured included: the ability to observe, plan experiments, propose hypotheses, use tools and materials, carry out the experiment. The results obtained were as follows: the ability to observe (38,24 %), planning experiments (16,56%), proposing hypothesis (19,4%), using tools and materials (12 %) and carrying out the experiment (14,5%). While the science process skills that includes the skill to interpret the results of observation, communication skills, the ability to classify and ability to predict showed an average value continuously of 21,6%, 7,37%, 8,14% and 8,6 % .

Based on survey results, observations, written questionnaire and vocational students' science process skills measurement results showed that the unimplemented lab skills impacted students' low science process skills. This showed that physics learning that did not give students the chance to utilize the tools directly that could be done in lab skill did not give real experience to students. Research continued with written

questionnaire involving 22 other vocational teachers in seven regencies of Central Java related to physics lab skill implementation. The results showed that 46% of physics teachers in vocational schools did not implement the lab skill in teaching physics. The reasons of why teachers did not implement the lab: 1. Lack of practical tools (tool availability), 2. Lack of meeting hours, 3. Physics of matter was more to the basic theory and had less support to the competency of vocational students. The next data obtained that 54% of teachers stated to implement physics lab, but the implementation in one semester conducted by each teacher in percentages were: ( once ) 7,14%, (twice) 7,14% , (3 times) 71,42% and (>4 times) as of 14,28%.

Implemented lab skill materials included mechanics, fluid motion and electric-magnetic. The results showed that nearly half of physics teachers involved as respondents did not conduct lab skill in learning physics, the teachers' arguments were as follows: 1. Vocational lesson hours were spent more to the practice in the workshop of building engineering materials, 2. Learning physics was just a theory and considered less support the competency in areas of expertise. This was where the issues need to be resolved, that was by accommodating the learning of physics that supported expertise competency through based physics lab skills through expertise competency requirement-based physics lab skill.

Based on the results of written questionnaire about teachers' perceptions to the development of the physics lab skills adjusted to the needs of expertise competency requirements showed that 84,6 % of teachers agreed, suggesting that expertise competency requirement-based physics lab skill gained support from the vocational school physics teachers . The reason given by the teachers was the continuity between the physics materials and subject matter of expertise competency, so that students could directly apply the physics materials on their fields of expertise and would support each other.

Based on what had been described, the physics lab skill could be developed based on expertise competency through no-fines Concrete technology. Development design could be described as follows:

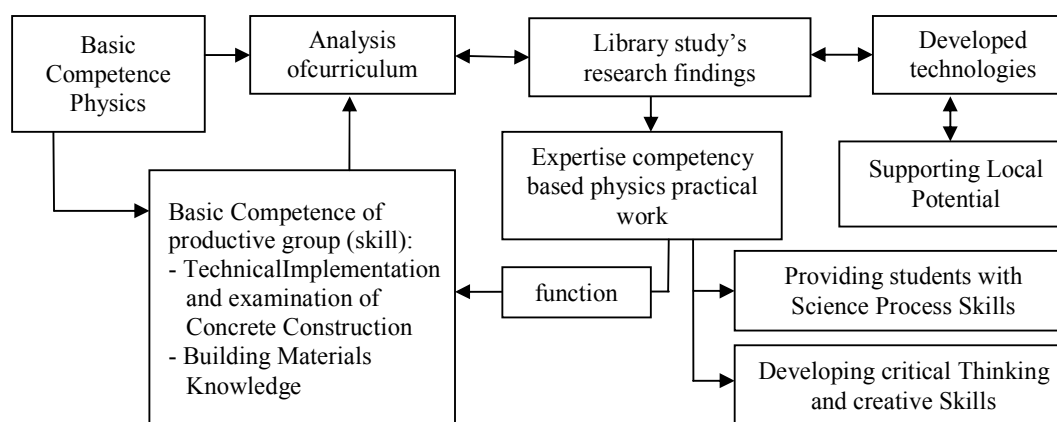


Figure 1. Scheme development design of expertise competency-based physics practical work

## CONCLUSION

The conclusions that could be raised from the requirement analysis phase are:

1. Physics learning in vocational school needs to be updated in the sense of not only the theoretical academic but also need to be supported with lab skill that can provide hands-on experience to the students and to develop a scientific attitude.
2. In order physics lab to support its function as supporting the achievement of expertise competency, necessary materials can be developed based on the curriculum analysis that connects physics' basic competence and basic competences in areas of expertise or productive groups, literature review on research findings, emerging technologies and local potential that can be developed.
3. Expertise competency requirement-based physics lab skill can also provide the students with the science process skill can develop critical and creative thinking skills.
4. Design development of expertise competency-based physics lab skills can also be developed in the field of Technology and Engineering Expertise Studies, Health and Agriculture with design preparation steps such as in Figure 1.
5. Expertise competency requirement-based physics lab skill is consistent with the basic learning curriculum in 2013 which emphasizes on: student-centered, interactive, active-probe,

the context to the real-world, team-based learning, stimulation to all directions (all five senses), multi-disciplinary knowledge (multidisciplinary approach), and critical (requires creative thinking).

## References

- American Association for the Advancement of Science (AAAS). (1993). *Benchmarks for scientific literacy*. Oxford: Oxford University Press.
- Departemen Pendidikan Nasional, 2007. Direktorat Jenderal Manajemen Pendidikan Dasar dan Menengah Direktorat Pembinaan Sekolah Menengah Atas.
- Faize, F. A., (2011). "Physics Teachers' Competency in Practical Skills – A Comparison of 'O' Level and Federal Board Students' Views in Pakistan". *European Journal of Social Sciences*. **19**, 4 - 555.
- Giancoli, D. C. (2001). *Physics with Applications*. New York: Prentice Hall.
- Hodson, D. (1990), Critical look at practical working school science. *School Science Review*, 70 (256), 34-40.
- Millar, R. (2004). The Role of Practical Work in the Teaching and Learning of Science (Commissioned paper) Committee on HighSchool Science Laboratories: Role and Vision. Washington DC. National Academy of Sciences.

## INCREASING THE LEARNING OUTCOMES AND THE CRITICAL THINKING THROUGH THE APPLICATION OF THE PROBLEM SOLVING APPROACH

**Riza Yonisa Kurniawan**  
Universitas Negeri Surabaya  
rizayonisa@yahoo.com

### **Abstract**

*The quality of education is played by many teachers as educators. to achieve a quality education, it is necessary to note the methods and models of teaching and teaching strategies that will be implemented by the teacher to the student. One model used is problem solving in which the model is expected to train students to face and resolve a given problem. Critical thinking skills and student achievement X.6 class SMAN 5 Malang still low, students still looks difficult to relate the material obtained in the school with problems that exist around them. The purpose of this study was to determine the application of learning models of problem solving in class X Senior High School 5 Malang, knowing the model of learning problem solving can improve students' critical thinking skills class X.6 Senior High School 5 Malang and to know the model of learning problem solving can improve student achievement X.6 class Senior High School 5 Malang. The subjects were students of class X.6 Senior High School 5 Malang number of students with a total of 39 students of which 13 students male and 26 female students. The results of this study indicate that there is an increase in critical thinking skills and student achievement during the administration of the action.*

**Keywords:** *problem solving, critical thinking skills, academic achievement*

### **BACKGROUND**

The development of science and technology are so rapid demand of human resources with expertise and skills in accordance with the needs and demands of the present age. Education is essentially an attempt to prepare the human resources with the expertise and skills according to the demands of nation-building, in which the progress of a nation can only be achieved through good education arrangement. Improving the quality of education is expected to increase the dignity of the Indonesian people.

Various attempts have been made to improve the quality of education among other various skills

training and upgrading teacher qualifications, curriculum improvement, procurement of books and teaching tools, repair facilities and infrastructure. The quality of education will be achieved if the learning process is efficient and effective for the achievement of knowledge and skills for graduate students in accordance with the demands of the times. In order for effective teaching and learning process and efisisen to note the existence of students' learning ability, the determination of the method of teaching used by teachers as well as teaching and learning strategy in accordance with the principles of teaching and learning.

The question now is how the teacher as a manifestation of his responsibility as educators of young people as well as take an active role in the success of government programs in education can broaden the diverse thinking of all students, so that they can learn the concepts and linking them with real life. This is a challenge that must be faced by teachers everyday, to be able to overcome these teachers should have extensive knowledge, creative and innovative in managing the learning process.

But in fact the field of learning is given by presenting the material as much as possible in accordance with the curriculum targets without providing the widest possible opportunity for students to practice. According to Ibrahim (2003:43) is widely used in a variety of teaching methods including lectures, teachers in the implementation of this method has a greater role in the delivery of teaching materials in accordance with the systematics that have been prepared. The traditional way is still regarded as an attempt to interpret the teaching of delivering textbooks as much as possible, so that students are expected to reveal that information back to the time of the test. The many roles of teachers in this method so that the matter quickly resolved in the near future but make students less active in learning.

Previous research underlying this study is the research conducted by Marpaung (2005) that the study of biology with problem-based learning activity sheets (LKPB) as an alternative

assessment to improve critical thinking skills are a positive influence on indicators of critical thinking, namely the formulation of problems, argument, deduction, induction and resolved the problem, and can improve learning outcomes which has a positive effect on a cognitive level. In another study Muslikhatin (2005) states that the application of cooperative learning model learning problems and investigations group model improves learning outcomes, both cognitive learning outcomes, affective, and psychomotor and critical thinking Traffic. It is characterized by an increase in the average value of the study subjects. Research conducted by Ariana (2006) also stated that the implementation of the integration model of problem-based learning and cooperative learning jigsaw models can improve student achievement. this can be seen from the increase in the average value of the study subjects. Arnyana research results (2007) shows that the model of Problem Based Learning (PBL) can (1) increase students' understanding of concepts Biology, (2) improve the problem solving abilities of Biology, (3) improve the ability to apply the concepts of Biology, (4) increase students' positive attitudes towards biology, and (5) increase students' critical thinking skills. Based on the results of an investigator - Hafid (2007) argued that effective problem solving strategies to develop critical thinking skills in teaching various subject areas.

## METHOD

This research is action research (Classroom Action Research) because researchers directly involved in the research process beginning to end of the study. Action research conducted by systematically collecting data about daily practices and analyze them to make decisions about which practices should be done in the future (Madya, 2006).

The research location is a place where research can look at the facts that occur during the learning process takes place. This research was conducted in March to April in SMAN 5 Malang Tanimbarese street address number 24 Malang.

The process of data collection in this study by using the following techniques : (1) Test, aiming to determine the increase in achievement and cognitive aspects of learning, especially as one of a series of learning activities in problem solving. Such tests include the initial tests (pre-test) and a test at the end of the cycle and end the test after the given action (post-test), (2) Interview in which the type of interview used in this study is a combination of interviews with the questions, (3)

Observation, engineering observation is used to determine the activity of the students in solving the problems presented by the teacher and measure students' thinking skills in solving problems during the teaching and learning activities that take place based on the observation sheet. In addition observations were also performed to obtain data on the harmony between the learning plan has been included in the learning scenario with the implementation of learning problem solving, (4) field notes, useful to obtain objective data that is not recorded on the observation sheet about the things that happened during administration actions.

## RESULT AND DISCUSSION

Cycle I taught the subject matter "Cost of production and revenue". The material is taught for 4 hours of lessons divided into 2 sessions. The time allotted for one hour lesson is 45 minutes. The first meeting begins with a pre-test and the second meeting ended with the end of the test cycle I.

Researchers in this study serves as a first cycle 3 teachers and peers as observers. 1 person observing teachers and students are 2 people watching. Observers record all activities that occur during the learning takes place. Observers record all observations in the observation sheet format and field notes.

Implementation of learning begins with the class teacher assistant (SMAN 5 Malang economics teacher) introduced to the students that starting today (Monday) to the subject of the cost of production, revenue and profit / loss completed the teacher will be guided by the new (research). When finished introducing themselves and explaining the purpose of the coming researchers, and teachers (researchers) provide pre-test as a pre- requisite knowledge (initial test).

The activity is intended to determine the students' prior knowledge of the subject matter prior to action. After administration of the initial test, the activities continued with the presentation beginning teachers (researchers) to convey the purpose of learning and the importance of linking the material studied and learned the usefulness of the material for other economic materials to be studied further. By the time the teacher gives explanations, students are involved in debriefing activities. It aims to explore students' prior knowledge. After the presentation of the learning material, the next stage is learning groups, in this stage the student is directed to understand the concept of production costs through text materials (modules) that have been given to each student. Students are required to sit on each predefined

group. Classroom atmosphere seemed rowdy when students join the group. Then each group looking for a problem and find a solution.

By the time the students work in groups, researchers and observers to observe and pay attention to all student activities. Researchers looked at all the group members to accept the presence of members of their respective groups. No conflicts in each group. Researchers sometimes stop at one of the group for their attention in a group task. If there are any questions from members of the group, the researchers asked beforehand to ask the members in the group. If members of the group cannot answer, the researchers did not directly answer the questions of the students but lead students to find their own answers to their questions. Researchers praised the group works well. For a group whose members are less eager to work and discuss, researchers motivate them with the award to be given to the successful group.

This was followed by presentation of the results of the discussion in front of the class by each designated group in turn. While other groups as a buffer and comment on the results of the advanced group performances. In this case the researchers are not many plays, only if there is congestion in the presentation, the researchers acted as a mediator in order to straighten out the answer is not quite right or wrong. This is done so that students are more active in learning.

Once finished with the class teacher discussion concludes material just discussed, there are many students who do not understand about the newly learned material, as before there are economic subjects replications of other subjects, so that less economic interest in learning so high. Many students are still talking about the replay just completed and some are still confused with the results of the group discussions were performed. So for the next meeting teachers assign tasks to each student to learn the material receipt and answer the question that is on the student worksheet.

In this first cycle, most of the time spent on discussion. So that the planned allocation of time cannot be done well. Receive unpreparedness of students in the subject matter is one of the causes of the loss of time that has been planned. In addition to recording the activity of discussion, student activity was also recorded by using the observation sheet which contains student assessment critical thinking skills in solving problems. At the second meeting of the next meeting, as well as at the first meeting, but the teacher did not introduce himself. Because the students already know the name of the

teacher (researcher), teacher greeting "Assalamualaikum" all students replied in unison "Wa'alaikumsalam Sir". Ask the teacher before class assignment given last week, "Is it done duty last week?". Then all the students replied, "Yes Sir" with simultaneously. The teacher explains the material that will be discussed at the second meeting that the material on receipt.

Students are asked to join each group, then discuss the problems that have been distributed prior to the meeting. After completion of the discussion groups and then designate a group of teachers who are ready to come forward to present the results of their discussion. The discussion was quite exciting, a lot of students who respond and refute the statement of the presenter. Due to the limited time given allocation, then not all of the answers can be answered by the presenter. But of the answers that the presenter has been described representative of the entire student questions and there are some statements that presenters must be straightened by the teacher.

In this first cycle of all aspects of the teacher implemented 100 %. This is done starting from the aspect explains the purpose of learning, to reflect on aspects of the learning process that has been done, but the teacher still has not been able to optimize the allocation of available time so much time is wasted in vain, the teacher also emphasizes student mastery of the material still less so in the second cycle students can better understand the material covered.

#### **Students Critical Thinking Skills Problem Solving Approach**

At the time of the discussion, the researcher with the observer observing each student activities and assessed based on the observation sheet that had been developed by researchers which contains 6 aspects of critical thinking skills. How to calculate the percentage of students' critical thinking skills is to divide the total value of the level of students' critical thinking skills in the field with a total value of students' level of critical thinking skills is ideal. The value of critical thinking skills base in this study was 4. Now we know the percentage of students' critical thinking skills, further classified according to the percentage of ketercapaiannya which consists of excellent, good, fairly good, not good, and not good.

In Cycle II teaches material that is the subject of "Profit/Loss". After the students into 8 groups, the teacher distributed to all students for the module to be referenced in the discussion group. Before the group discussion the teacher presents the material started a course outline and submit tasks to each

group to work with. In a group discussion, the teacher guides the discussion group by way around to each group. In guiding the discussion of the interaction between teachers and students.

At the time of the discussion, the students appear to be more active when compared to the discussion in cycle I. This was seen at the time of the discussion and ask students actively work together to mutually accomplish the task given by the teacher group. Students feel a sense of responsibility to the group that received the highest scores from other groups however there are still some students who jokingly. Groups that were active were group 1, 4, 5, 6 and 8.

After the discussion of learning activities followed by a presentation of the discussion. Because a lot of time spent on the presentation, the teacher pointed to a couple of groups that are ready to perform. and other groups as a buffer if the answer is less appropriate than the presenter or presenters disagreed. At this time a lot of the discussion groups and provide arguments to refute each one for each group not to be outdone by other groups. and this time there is no lesson that interfere with the replication of other subjects so that all students are focused on economic subjects. Teachers continue to provide additional and straighten out the answer if there is an answer that is less than a statement of the student.

The next activity is the provision of the final test cycle II. The number of questions given is 10 and 5 questions about the objective description. In doing the test is the same as the first cycle, students are prohibited to work together with other students. The result is that the individual scores then summed and averaged as group scores.

In this second cycle of all aspects of the teachers also implemented 100 %. (can be found in appendix 6). This is done starting from the aspect of learning to explain the purpose of evaluating the learning outcomes and students' critical thinking skills, reflect on the learning process has been carried out from the first cycle teachers already make improvements is to allocate time according to the scenarios that have been made, students already interested and in the presence of a teacher can motivate them to learn and solve problems, and students can receive course material easier to understand compared to before getting learning with problem solving approach.

#### **Students Critical Thinking Skills Problem Solving Approach**

The observation of critical thinking skills in the second cycle is a very large increase, this is because the students already understand the

importance of this material in everyday life and individual students are not busy with other subjects that replicates the concentration of the students focused only on economic subjects. During the discussion of female students is more dominant role than men. This is because the composition of the number of men is only 12 people while the number of women 27. So it seems more women are active in the discussion. Female students possess a literature book more complete than the male students that the material that they find a more reverensi material. Although the number of men is only half of the women did not discourage them in following the discussion. This is evidenced by the activity of male students when asked in the discussion, they adopt a more logical reasoning and can be accepted by other groups. While there are some groups of women are still less precise and rational decision-making and away from the answer desired by the questioner. But even so there is one of the most dominant women's groups in expressing their opinions and arguments, so it can be received by all students.

#### **CONCLUSION**

Application of the method of problem solving learning done in 5 stages. Stages in the study are as follows : (1) a class presentation stage, the researcher presents the objectives of learning, motivate students, and linking material importance and usefulness of the material to be studied for materials other economies that will be studied. To help students understand the subject matter, researchers brought students to the real world that is often experienced by students in the classroom, (2) study group, in an effort to solidify students' understanding of the subject of the cost of production, acceptance and Profit / Loss, conducted the study group. each group consisted of 4-5 students discuss exchange ideas, and work in completing tasks and find alternative solutions to the problems faced.

In this study group, students complete tasks that exist in the sheet material and worksheets ; (3) individual tests, tests of each end of the cycle to be completed by the student. In completing the test, students must demonstrate mastery of the material so that the individual is not allowed to ask each other, although with a friend one group, (4) points of individual and group development, are shown to provide awards to students on their work better than ever. Improvement of individual points calculated by finding the difference between the baseline score and then score the final test cycle compared with established criteria. Further development of the

group points to calculate the average of points earned each individual in the group, (5) a group award, announced at the beginning of the previous meeting held after the test. The successful group was given a gift of (Snack and stationery).

Application of economic methods of learning with problem solving approach in senior high school 5 Malang can improve students' critical thinking skills. It is evident from the increase in the average scores of students' critical thinking skills at each end of the cycle, both cycles I and II cycle. Application of economic methods of learning with problem solving approach in senior high school 5 Malang can improve student achievement. It is evident from the increase in test scores at each end of each cycle, a lot of students who have achieved mastery learning established by the school that is equal to 75, as many as 35 students from a total of 39 students in total students that scored above 75.

Learning problem solving model to improve the students' pleasure. By learning groups, students discuss, exchange ideas and help each other so that they can solve the problem quickly. Students participating in learning and excited states expressed more easily understand the subject matter.

## References

- Ariana, Arifandi. 2006. *Keefektifan Penerapan Model Pemaduan Pembelajaran Berbasis Masalah dan Pembelajaran Kooperatif Model Jigsaw dalam Meningkatkan Minat dan Prestasi Belajar Siswa pada Mata Pelajaran Ekonomi di SMA Negeri 5 Ponorogo*. Skripsi. Tidak diterbitkan. Malang: Fakultas ekonomi.
- Arnyana, Ida Bagus Putu. 2007. Penerapan Model PBL Pada Pelajaran Biologi untuk Meningkatkan Kompetensi dan Kemampuan Berpikir Kritis Siswa Kelas X SMA Negeri 1 Singaraja Tahun pelajaran 2006/2007. *Jurnal Pendidikan dan Pengajaran UNDIKSHA*, No. 2 TH. XXXX April 2007
- Garry dan Kingley (1970) dalam Sudjana. 1996. *Cara Belajar Siswa Aktif dalam Proses Belajar Mengajar*. Bandung: Sinar Baru Algensindo.
- Hafid, A. 2007. Mengembangkan Kemampuan Berpikir Kritis melalui Teknik Problem Solving. *Jurnal Penelitian dan Pengembangan Keilmuan Secara Aktual*. (Online), 5 (3):126-277, (<http://digilib.unm.ac.id>)
- Ibrahim (2003) dalam Saraswati. 2005. *Pengaruh Pengajaran Modul Terhadap Prestasi Belajar pada Mata Pelajaran Akuntansi di SMK PGRI 3 Blitar*. Skripsi tidak diterbitkan. Malang: FE Universitas Negeri Malang.
- Madya, Suwarsih. 2006. *Penelitian Tindakan: Teori dan Praktik*. Bandung: Alfabeta.
- Marpaung, Rini Rita T. 2005. *Penggunaan Lembar Kegiatan Berbasis Masalah (LKPB) sebagai Assesmen Alternatif untuk Meningkatkan Kemampuan Berpikir Kritis dan Hasil Belajar Biologi Siswa Kelas VII SMP Laboratorium Universitas Negeri Malang*. Tesis tidak diterbitkan. Malang: Program Pasca Sarjana Universitas Negeri Malang.
- Mbulu, Joseph. 2001. *Pengajaran Individual: Pendekatan, Metode dan Media Pedoman Mengajar bagi Guru dan Calon Guru*. Malang: Yayasan Elang Mas.
- Muslikhatin, Yayuk. 2005. *Penerapan Pembelajaran Berbasis Masalah dan Kooperatif dengan Tipe Kelompok Investigasi untuk Meningkatkan Hasil Belajar dan Kemampuan Berpikir Kritis Siswa Kelas X SMA Lab UM pada materi ekosistem*. Skripsi. Tidak diterbitkan. Malang: Fakultas Matematika Dan IPA.
- Nasution, S. 2000. *Berbagai Pendekatan dalam Proses Belajar Mengajar*. Bandung: Bumi Aksara.
- Simanjuntak, B, IL Pasaribu. 1985. *Didaktik dan Metodik*. Bandung: Tarsito.
- Sudjana, Nana. 1996. *Cara Belajar Siswa Aktif dalam Proses Belajar Mengajar*. Bandung: Sinar Baru Algensindo.
- Suherman. 2003. *Common Text Book: Strategi Pembelajaran Matematika Kontemporer*. Bandung: IMSTEP JICA.

## THE LEARNING OF SPEAKING AND WRITING USING ICT (INTERNET IN THE CYBER CLASSROOM) FOR THE STUDENTS OF SENIOR HIGH SCHOOL

Sony

Post Graduate Program of English Education  
Ahmad Dahlan University

### **Abstract**

*There are four language skills namely listening, speaking, reading, and writing in studying English. In the teaching learning process, some teachers only emphasize on grammar and reading skills to answer from the text just for comprehension. The learning like this will not focus on the learning English as tool of communication. So the students only get good mark but they do not have the skill to use English as tool of communication. Some students do not master the speaking and writing as the productive English skill. As we know that the people communicate with other with are not only use the language especially English directly or face to face but also they can communicate by using Audio Visual Aids (AVA) like the computer. From the computer we can access many information and knowledge from the program of computer like internet. The learning of speaking and writing using ICT (Internet in The Classroom) can be practised by the students who want to improve their global mind set oral and written competence by using internet. From the result of learning speaking and writing that the student who want to improve their global mindset oral and written competence by using internet. From the result of teaching learning speaking and writing that the students can speak by chatting in the internet and the students also write a type of genres like: story writing, letter to a friend, recount, and description (place, person and thing). From the internet the students can learn speaking using internet. This can be done by chatting with foreigner from many countries and they can write a letter, messages, story, recount, and description, of place, person or thing in the internet to communicate with others. By doing this project is hope teachers can increase the quality of students' competence in English actively. In addition the students have skills of assessing information using communication technology.*

**Keywords:** *The learning of speaking and writing, ICT (internet), Cyber Classroom*

### **BACKGROUND OF STUDY**

English as International language has spread all over the world. In global era that there is no limit between countries to communicate, relationship, assessing the information and shared in social life, nationality, and country in Indonesia can not be separated from the global influences, the rapidly progress which happened in science and technology art and culture. Mastering English is the key for us take part in the global era (we can speak) access information, adopt and make competitive with other countries in the world. Information in various kinds of forms to a certain extent is considered as the most enjoyable entertainment in satisfying intellectual curiosity, sharing the right to communicate, and giving perspective to the meaning of life, based on consideration above, people keep trying to minimize the kind of disturbances they meet in their communication.

The learning of English which is only emphasis on grammar and the skill to answer from the text just for understanding items. The learning like this will not focus on the English learning as tool of communication. So the students only get good mark but they do not have the skill to use English as tool of communication. So the students do not master the language competence like listening, speaking or writing actively. As we know that the people communicate with other not only use the language especially English directly or face to face but also they can communicate by using Audio Visual Aids (AVA) like the computer. From the computer what we can access many information about anything what we want and we need.

Computer is an automatic device that performs calculations and makes decisions and has the capacity for storing and instantly recalling vast amounts of information. It processes information that can be represented in many forms, including numbers, letters, words, sentences, sounds, pictures, formulas, control signal, punctuation marks and mathematical signs. The processing is controlled by a set of step-by-step instructions called a program. From the explanation above,



we realize that technology development always changes time to time which offers easiness for live. So the new learning will be recommended which benefit the source of learning that can be used, it is applicated and utilized for active English learning and fun. From internet the student can learn speaking indirectly without face to face with others from many countries and they can write a letter in the internet to communicate with others. This learning will be given to the students on the first, second, and third class with the small group. By doing of this project is hoped it can increase the quality of students competence in English actively and information communication technology skill.

#### METHOD OF THE STUDY

In this study the writer used qualitative research. Qualitative research is a research where the data is done by description of the data deeply.

#### DISCUSSION

##### A. The Learning of Speaking Using Internet

As a language skill, speaking is sometimes under evaluated or, in some circles, taken for granted with recent growth of English as an international language of communication. There is clearly a need for many learners to speak and interact in multiplicity of situation through the language for foreign level, business or other professional reason. Generally, as we know that speaking identically with oral. So we can do speaking if we can meet the people face to face or directly. Here, the writer tries to explain, that speaking can take place not only face to face or directly, but also indirectly or using media. We can speak with other do not have to use English which pronounce it orally, but we can practice speaking by writing of the expressions. So it called spoken written. It means that the conversation which happens by writing expression. We can write a message or to take something (information) on the internet with more simple sentence, free, and more understandable. It does not always consider about the grammar and sentence structure. One of the application speaking using Internet is chatting.

As we know that chatting has several steps to do. According to Supriyatna (2000: 5-6) to connect chatting has the following steps:

- a. Click start
- b. Look up the program
- c. Look up MIRC
- d. Click MIRC 32
- e. Wait until the dialogue box about MIRC is out
- f. Click close button ( X )

- g. So it will show the dialogue box MIRC set up
- h. Kill our data with our the address of e-mail in box which is available, and the click OK or click CANCEL to pass the dialogue box.
- i. Then it will be shown MIRC on the window
- j. Click general option
- k. Click the connect to IRC server (wait)
- l. In enter name of channel to joint box typing the name of channel where you want to joint (e.g # bawe # Indonesia , # Bandung or others)
- m. Click Add , the click Edit after that click joint
- n. So it will take out the name that available (for example : "ganteng"). So it will take out the appearance and start the talk, typing, Hai, enter. And the click the name its channel in order that our message to go through (the appearance can be managed to look interesting and informative, ask to your tutor)
- o. Next, please wait the answer from the man who is pointed
- p. After answer please back click your answer, push the enter, then back click its channel in order that our message to go through
- q. Thus so on finish
- r. Happy chatting

##### B. The learning of Writing Using Internet

Writing is a learnt skill and therefore, it is normally learnt through the process of instructions. One has to master form of the language and learn certain structures which are less used to in speech, but which are important for effective communication in writing (Byrne, 1990).

The writer tries to explain the use of the internet as a teaching aid for a writing class. The students might be thought writing with different genre. Some writing different genres that it will be discussed such as a letter to a friend, story writing, description of place, person, and recount.

##### 1. On-Line Class

The teaching on line is more interactive than teaching offline. The on-line class focuses on how to use internet. The internet can be used to motivate students in their efforts to acquire English proficiency skills. Students will be involved in tasks that require them to participate in class to learn how to use the internet for general writing purposes and create texts.

##### 2. Essential Factors to Consider in Teaching On-Line

##### a. Teacher

The teacher should be aware of all the complexities of on-line learning environment such difficulties in scheduling the access to the computer in the

lab or the students who do not have their own computer. During the on-line lesson, the teacher needs to be extremely active monitoring students from viewing material that is not appropriate for them, and finally maintain their attention and guide them on the web sites so that they become focused on the assigned tasks.

b. Resources

When considering the resources for conducting on-line lesson, it is suggested that the teacher must have a computer lab with internet access with the least one computer per two students, with relatively task internet connection.

c. Writing genres with the internet

The writer tries to explain the techniques how to teach each writing genre with help of the internet. The techniques proposed for teaching different genres are based on the web sites provided students with information they need, to be later used as a model in writing.

### C. Cyber Classroom Model

1. Preparations are :

There are 6 actions

- a. Preparing set of hardware and software internet lab.
- b. Holding the internet using training for 4 weeks
- c. Giving job description
- d. Explaining the purpose and target of activity
- e. Making the result of the students work web site
- f. Making evaluation

2. The Action of Scenario

- a. Giving explanation the program of cyber classroom
- b. Doing learning activity
- c. Discussing the result
- d. Sending written via email to other friend
- e. Senior high school in West country
- f. Downloading letters from other country
- g. Doing evaluation

3. The Action

The application of the learning speaking and writing using internet in the cyber classroom is the second class of Language Department Senior High School divided into groups, which are consist of 5 or 6 students. Every group gets different assignment from other group depend on the theme which gave and wrote the report in English, every theme has

sub theme which will be responsible for every group.

### D. The Using of ICT Model

1. Preparation

- a. Supply hardware and software
- b. Holding internet training for three section
- c. Making the work program and the activity agenda
- d. Making evaluation form

2. The Teaching Scenario

- a. Giving the assignment to carry out in internet laboratory
- b. Doing learning in internet laboratory
- c. Gathering the result of students work
- d. Presentation the result of work
- e. Using the result of rest material of learning
- f. Doing evaluation

3. The Learning Activities

Learning in internet laboratory can be done twice a week or minimally once a week. The English teacher together with the students decide the activity which will be done in the next section (in English CBC is called conferencing), the students divided into the small group minimally 2 students. The activity which is done by every group is the same.

4. The Benefits of ICT

The aims of English learning in CBC are to master the discourse competence in oral and written form. To reach this aim, the biggest problem is the lack of exposure toward using English. The benefit variety of learning source includes learning media in it. It will give big contribution in effectiveness to reach the aims of learning. One of the invention by review team sector that the use of learning media will be able to decrease teachers' trouble until 1/3 information communication technology of ICT. In this case the internet can be used to learning media by UTILIZATION means that intentionally designed to learning media but can be found applicated and used to the learning need. All on line activities give exposure or introduction of English learning directly from native speaker. Many of exposure highly oral and written competence mastery quickly. These are examples of internet services which can be used to exposure English from native speaker. They are browsing, On-line learning, E-mail, On-line communication or Chatting and personal web.

## CONCLUSION

Based on the explanation above, the writer concludes that:

1. Applying internet for speaking and writing:
  - a. The learning of speaking using internet for the Senior High School students are done by chatting. From chatting, the students can improve their spoken written skills.
  - b. The learning of writing using internet for the Senior High School students are done by writing with different genres like : a letter to friend, story, description (place, person and thing), and recount.
  - c. The students can get markis 7-8,5 in their evaluation.
  - d. The students get the balance between speaking and writing skills in the activity in cyber classroom.
  - e. The students feel excited because they have in the International Class atmosphere.
2. The benefit of internet for learning speaking and writing:
  - a. Cyber classroom learning model and ICT gives positive contribution towards the increase of students competence mastery both in oral and written English.
  - b. The benefit of ICT is optimizing English exposure from native speaker and native country.
  - c. Giving unlimited learning source is accessed by the students and as a cultural competence.
  - d. Giving positive contribution towards native country cultural understanding and other countries (multicultural understanding)
  - e. Increasing the students skills with goal mindset.
  - f. Giving positive contribution towards the increasing of the students ability by using and benefiting of the ICT as learning source and global communication medium in International Values.

## References

- Anderson, Mark & Anderson Kathy. 1997. Text Types in English. Mac Millan Education Australia Pty Ltd: Malaysia.
- Ardiyati, Wienny. 2005. ICELS "Information Technology and English Language Studies: The Graduate Program (S2) in English Language Studies. Sanata Dharma University: Yogyakarta.
- Brown, H.D. 1997. *Principles of Language Learning and Teaching* Englewood Cliffs. NJ: Prentice Hall.
- Brown, H. Douglas. 2001. *Teaching Principle an Interactive Approach to Language Pedagogy*. Eddison Wesley: Longman.
- Gusnarwanto. "Teaching Writing by Retelling Folktales at Junior High School of Grade Second", A Paper. Muhammadiyah University of Purworejo, Purworejo, 2005. (Unpublished Writing).
- Harmer, Jeremy. 2001. *The Practice of English Language Teaching*. Malaysia: Longman.
- Hartono, Rudi. 2005. Genres of Texts. English Department Faculty of Language and Art: Semarang State University (Unpublished Writing).
- Komidah, Siti. "Teaching Sepaking Using games for Senior High School Students as an Alternative Way to in Crease Student's Speaking Skill", A Paper. Muhammadiyah University of Purworejo, Purworejo. 2004. (Unpublished Writing).
- Mulyasa, E. 2005. *Kurikulum Berbasis Kompetensi (Konsep, karakteristik dan Impelementasi)*. Bandung: PT Remaja Rosdakarya Bandung.
- Nurbaiti, Nikmah. 2005. *Makalah Inovasi Pembelajaran*, SMA Negeri 7 Purworejo.
- Purnawati, Tri. "The Effect of An Interest in English to the Writing Competence of the Fifth Semester Students of the English Departments of Muhammadiyah University of Purworejo in the Academic Year of 2001/2002", A Thesis, Muhammadiyah University Purworejo, Purworejo. 2002. (Unpublished Writing).
- Rade Macher-Gibson. 1983. *An Introduction to Computers and Information System*. USA: South-Western Publishing CO.
- Suhartono, "The Teaching of Vocabulary and Grammar to Improve Student's Speaking Ability of Junior High School" A Paper. Muhammadiyah University of Purworejo, Purworejo. 2000. (Unpublished Writing).
- Supriyanta, Uji. 2000. Panduan Praktis untuk Pemula dan Menengah: E-mail & Chatting. PubeNet: Purworejo (Unpublished Writing).
- Wong, Rangxian. 1990. *Focusing on Oral Communicative Competence*. English Teaching Forum. Januar.

## FIVE WAYS TO PROMOTE CREATIVITY IN THE CLASSROOM

**Ummu Rosyidah**

Post Graduate Program of English Education  
Ahmad Dahlan University of Yogyakarta

### 1. BUILD UP SELF-ESTEEM

Many adults still suffer from the negative impact of their schooling; this pillar really explores ways in which children can be encouraged to build inner resilience and self-belief.

Many references mentioned self-belief and the power of positive thinking. National sports teams, businesses and individuals are continually being encouraged to develop self-belief; therefore isn't the most logical place to start with the younger generation?

There is a strong belief by the writers of many personal development and self-help books that if you really believe in something you can make it happen; it is the power of positive thought. Another way of describing it is 'self-talk'. Shad Helmstetter in *What to Say when You Talk to Yourself* (1998) argues powerfully about the need to programme your brain into positive thoughts rather than the negative messages that we receive in our lives.

One of the sad realities is that many people underachieve, often as a result of the feedback that they receive from others. Parents, teachers, friends and partners are often responsible for giving (often unsolicited) advice or feedback which so undermines an individual's confidence that they give up on a plan or course of action because of doubts fuelled by someone else. What this often does is to reinforce the concerns that they may already have.

Helmstetter says that leading behavioral researchers have told us that as much as '77% of everything we think is negative and counterproductive and works against us'. He then asks:

*What if each and every day, from the time you were a small child, you had been given an extra helping of self-confidence, double the amount of determination, and twice the amount of belief in the outcome? Can you imagine what tasks you might accomplish more easily, what problems you would overcome, what goals you would reach? ... Could it be that those who appear to be 'luckier' than the rest have only gotten a little better programming? ... It is no Building self-esteem 95 longer a success theory ... The brain simply believes what you tell it most.*

Closely related to self-confidence is what psychologists call 'self-efficacy', the positive judgment of one's own capacity to perform. Self-efficacy is not the same as the actual skills we have, but rather our belief about what we can do with the skills we have. Skill alone is not enough to guarantee our best performance-we have to believe in our skills in order to use them at their best. Goleman, in *Working with Emotional Intelligence* (1998) (see 'Recommended reading'), quotes from the work of Albert Bandura, a Stanford University psychologist who pioneered the study of self-efficacy, who points out the contrast between those who doubt themselves and those who believe in their abilities when it comes to taking on a difficult task.

Those with self-efficacy gladly step up to take the challenge; those with self-doubt don't even try, regardless of how well they might actually do. Self-confidence raises expectations and raises aspirations, while self-doubt lowers them. Goleman goes on to state that 'there is a tight link between self-knowledge and self-confidence. We each have an inner map of our proclivities, abilities and deficiencies.' He quotes from two studies:

*In a decades long study of managers at AT&T, self-confidence early in a person's career predicted promotions and success in higher management years later. And in a sixty year study of more than a thousand high IQ men and women followed from childhood through retirement, those most self-confident in their early years were most successful as their careers unfolded.*

Brian Tracy in *Maximum Achievement* (1993) takes a similar line:

*Children who learn to build and maintain their own levels of self-esteem have far better self-concepts than children who do not. Children with high, positive self-concepts do well in school. They do not engage in vandalism, or get into trouble. They don't do destructive things to their bodies. They are more capable of resisting the negative influences of their peer groups. They have stronger characters.*

Children with high self-concepts, high self-esteem are independent in their thinking. They are more likely to think for themselves, and to orient themselves toward success, achievement and

personal fulfillment. They are more focused on realizing their potential than on compensating for their deficiencies.

He also suggests that, when children feel good about themselves, they develop better judgment about the things that are good for them in the long run. They develop the ability to delay gratification in the short term in order to enjoy greater rewards in the future.

So how do you help children develop a positive self-concept? In reality this is not something that teachers can achieve on their own; it has to be part of a relationship between the child, the parents and the teacher. However, by understanding it and reinforcing the principles you can play a major role in helping a child to develop it. Tracy suggests that a self-concept is made up of three parts:

- Self-ideal. He suggests that a person's self-ideal is a vision or an ideal description of the person that someone would most like to be. This may be a combination of values, qualities and attributes and sets the standards for an individual.
- Self-image. Again Tracy's view is that your self-image is the way that you see yourself and what you think about yourself and how you go about your daily duties. He describes this as your 'inner mirror' and suggests that you 'always behave consistently with the picture that you hold of yourself on the inside'. Powerfully, he suggests that it is possible to improve one's performance by changing the mental pictures that you hold about yourself in that area. I referred to the work of performance coaches at the start of this chapter, and much of their work is in the area of helping individuals to visualize a more successful person. As people begin to see themselves as becoming more confident and, importantly, as winners, their behavior becomes more focused and confident.
- Self-esteem. The third part of the self-concept is self-esteem. Tracy describes this as 'the source of energy, enthusiasm, vitality Building self-esteem 97 and optimism that powers your personality and makes you a high achieving man or woman'. He suggests that your level of self-esteem is determined by two factors: how valuable and worthwhile you feel you are and how much you like and accept yourself as a good person; and your feeling of 'self-efficacy', as described by Goleman. He suggests that the two sides of your self-esteem reinforce each other. When you feel good about yourself, you perform better, and when you perform well you feel good about yourself.

He sums this up by suggesting that the best measure of self-esteem is how much you like yourself, and states:

*The more you like yourself, the better you do at everything you put your mind to. The more you like yourself, the more confidence you have, the more positive is your attitude, the healthier and more energetic you are and the happier you are overall.*

This has enormous implications for teachers and parents. Children are not born with a self-concept; it is developed through interactions and feedback from the adults in their world.

#### **a. Paradigm Shift**

Another useful technique is paradigm shift. The logic behind paradigm shift is that you are helping people to make a mindset change. By encouraging a shift from a negative to a positive perspective you are helping them work to achieve what they really want. It builds on the principles of visualization: visualizing what it could be like and then moving further forward into identifying how it could feel. It can range from quite basic human activities like getting up in the morning to the more personal and aspiring, e.g. 'I want to be successful in achieving what I want from life.'

By shifting their personal perspective from disbelief to belief the individual learner can start to work to achieve what they really want. The real issue is that it is easy to say, but much harder to achieve. The role of the teacher as coach can be to help the individual to keep reaffirming their beliefs, help them to identify strategies for achieving the shift and reinforce their embryonic steps towards achieving the reality:

- 'I want to get up easily in the morning – I enjoy getting out of bed and the beauty of mornings.'
- 'I want to be fit and healthy – I am a fit and healthy person.'
- 'I want to be able to network with confidence – people will find me interesting and stimulating.'
- 'I want to achieve my ambition – I have already started and am going to achieve it.'

In each case the first step towards achieving a mindset change is to begin to live as if the shift had already taken place. If I want to get up easily in the morning, what do I need to do to shift my perception of what enjoying getting up feels like? How could I make the mornings? a more pleasant experience?

If I want to be more interesting and stimulating, how would it feel to be this person? What behaviors do I need to display? Importantly, as discussed in Chapter 4, this will not be achieved overnight, but the first step is helping a student believe that it is possible. Inviting in speakers who

have overcome self-doubt, sharing case studies of people who have overcome adversity, and also giving each individual student time and support and positive feedback can help them take their first tentative steps forward. It is also important to maintain this support and to keep supporting them when they falter on the way or when they reject help.

#### **b. Helping Individuals to Believe in Themselves**

Building on from the concept of 'paradigm shift', one of the most important acts that an adult can do for a child is to build their self-belief. From the moment that a child is born, the feedback that they receive defines their perception of what they can and cannot do. As adults we cannot and must not limit another person's belief by our own views on what is achievable. There are specific actions that we can do to help young people develop self-belief:

- Believe that each child is different, that they have their own unique combination of intelligences, learning abilities, hopes and desires and, therefore, do not judge them by other children. This particularly applies to younger siblings, who often suffer as a result of the expectations of the similarity, or not, to the their older brothers or sisters.
- Be committed to supporting their development through positive feedback. Remember the quote from Thomas Edison, 'I haven't failed; I have just found 10,000 ways that won't work.'
- Help children build a positive mindset. The body responds to the messages that are sent from the mind. The way someone stands, the speed that they move and the way they respond to the environment around them are based on the messages that their mind sends them. Don't just tell them about a paradigm shift; help them live it each day. Think of all the messages that a child receives each day from family, peers and school; encourage them to develop their own filter.
- Help them to overcome failure. This is particularly true at examination time. Have positive examples of people who have failed and how successful they have become in their own field.
- Remind them that tomorrow is a new day. However hard a particular day has been, however hard life has been, none of us can predict what will happen tomorrow, so encourage them to see it as an opportunity to start afresh, taking with them the wisdom from the past, but with new hope for the future.

#### **c. How to Develop Others**

There are a number of practical day-to-day actions you can take to help children of all ages develop:

- Help them to help themselves.
- Provide a stimulating learning environment.
- Keep a sense of FUN about learning and life.
- Be optimistic and give them a sense of hope in their future.
- Treat each child as an individual.
- Draw the best out of each child.
- Recognize their natural talents and be encouraging.
- Provide a support system.
- Do not hold back creative students; take pride in developing them. Encourage their involvement in different projects.
- Champion and be willing to promote the ideas of students and help them to build new skills by building from small to greater responsibilities.
- Be prepared to share your expertise. Help students to succeed by giving positive and constructive feedback. Seek feedback on your effectiveness.
- Encourage students to build personal development plans, and clearly identify with them their strengths and development areas. Work to create opportunities for them to develop new understanding of their personal capabilities.
- Offer ongoing support and additional learning and coaching opportunities.
- When they leave your class, maintain an interest in their development.
- Invite into school or college role models who can track their journey, people who are more maverick, people who have followed non-traditional roles and people who have overcome adversity.
- Don't see it just as a one-off activity; it needs to be ongoing.

#### **2. MODEL CREATIVITY YOURSELF**

Faced with a pile of marking, Monday morning, an unruly class, difficult parents, demanding school head, unhelpful colleagues and challenging governors, you could easily forget that there is a creative world waiting to be discovered.

How well do you know yourself? How far do you push the boundaries of discovery? What do you do to inspire yourself? Would you describe yourself as creative? Over the years I have worked with many people in helping them develop their creativity. What is interesting is how many people are reluctant to acknowledge their creativity. If I

ask a group of any age ‘Would you describe yourself as creative?’, there is a lot of looking down at their hands. Very few people want to acknowledge that they might be creative. I have also heard very young children say, ‘I cannot draw. I’m rubbish at art.’ What is important in any debate about creativity is to recognize the scale and scope of it. It is not just about the arts; it has a much broader perspective than that. If we take the dictionary definition, ‘Inventive and imaginative, creating, or able to create’ (Concise Oxford Dictionary, 9th edition), it is possible to see that this can be applied to any discipline. I would also venture to suggest that it is almost impossible to be a teacher if you do not have some element of creativity. I know that some teachers feel that some of the constraints of the curriculum are denying them their creativity, but most respond with energy and vigor to accommodate the curriculum within their creative mindsets. In some cases the ingenuity of their ideas and the opportunities that they create for learning go much further than the standards suggested in the National Curriculum.

Where these ideas come from is sometimes hard to define. Inspiration cannot easily be anchored down and looked at. It is a sense, a feeling and a mood, something that lifts you above the ordinary and enables you to achieve something special. Being inspired transcends the normal day-to-day activities. I have already mentioned ‘flow’, and more and more people are becoming aware of how this works. There are techniques that stimulate it which have already been mentioned. It is, however, I think, worth mentioning again that there are conditions that help to stimulate creativity.

**a. ‘What are The Best Conditions That Help You to be Creative or Innovative?’**

This was one of the questions in a survey that I asked for *Managing the Mavericks* (Thorne, 2003 – see ‘Recommended reading’).

The responses reveal a richness of stimuli, ranging across outside environments to organizational teams and individuals’ own domestic space. A number of respondents gave examples of when they are in ‘flow’. Freedom is often mentioned, as is feeling relaxed and, when discussing preferred working environments, a need to be stimulated through the senses. Other people are also important for some respondents, either as sounding boards or just to talk to, socialize with or have there to welcome them back from their thinking time. Others mention that deadlines, challenges and pressure also help them to be creative.

**b. Identifying Sources of Inspiration**

As has been highlighted throughout this book we are all different and as such will be inspired in very different ways, but here are some thoughts to add to those above. One way of being inspired is to start looking much more closely at the things around you.

Go to an art gallery and go as close to a painting as a curator will let you; marvel at the detail in the brush strokes; now back right away. What is different? Visit modern art and some old masters; look at sculptures; try to get inside the artist’s mind. Look at some more obscure art; see if you can identify what the artist is trying to say.

When people’s lives are busy they sometimes forget what richness exists simply by observing, and consequently their creativity doesn’t flow because it cannot fight its way through the clutter. Another way of stimulating your creativity is to practice being an artisan. Traditionally, artisans are workers and craftspeople; they create things; they make bread, grow vegetables and carve in wood or stone. In today’s society, many people have a secret dream of being an artisan, creating things to sell at a local market. While this may seem a romantic dream, the making of things is another way to slow down and let your creativity flow. While kneading the bread or tending plants you may suddenly find you have thought of the solution to a problem that has been bothering you for weeks.

You may feel that you lack the skills to do anything creative, but most things can be taught. It’s never too late to learn a musical instrument, to take singing or dancing lessons, or to learn to paint or sculpt. You may not become a Michelangelo or a Renoir, but you can have tremendous fun learning, and what you create will give you as much a sense of achievement as if it were a masterpiece. This doesn’t apply just to making things. Designing a garden, instructing an architect or finding a solution to a problem can all involve creativity.

**c. Idea Generation**

So where do people get their ideas from? In reality there are a number of sources and triggers, and the more you open your mind up to learning and use different approaches and techniques the easier you will find it to identify new ideas. If you want to stimulate your mind to come up with ideas, the secret is to relax and let your subconscious do the work. Ideas often occur when we are least expecting them and when we are doing other things. Many people who have been searching for a solution to a problem find the solution occurs once they go and do something else. As already mentioned, this can happen when you are doing

something quite mundane like cleaning the car, ironing or taking part in some physical activity.

However, what is even more important is that, when your mind is clear and your ideas are running freely, you need to make the most of this special time. If you find that you have hit a creative period, you need to capture your thoughts because they will come at a pace which may surprise you. Some people find it easy to generate ideas, but most find it a challenge; therefore you need to use a variety of methods to help you stimulate your mind. When you find your creativity is being stifled, take a break and do something completely different. Take regular time out to indulge yourself. Use others for support and to bounce ideas off, however crazy. Build on initial fleeting thoughts to anchor more tangible concepts. Unlearn lessons from childhood; say 'I can' instead of 'I can't'.

### 3. OFFER CHOICE

Last holiday, I went to Baron beach, Gunung Kidul, Yogyakarta. While my husband and I waited on the shore for the darkness to signal the start of night displays, we were intrigued by an enterprising young man working his way through the people sitting in folding chairs and on picnic blankets.

He was a balloon artist, and his simple business plan was proving to be very effective. He would ask a child what he wanted, and he would create it for him. We watched, amazed, as he made flowers, swords, poodles, Spider-Man (it was awesome), scepters, and crowns. There seemed no limit to what he could create with simple balloons.

He had no want for customers, as they flocked to him rather than the other way around. He probably made enough money that night to cover much of his monthly living expenses!

In differentiating our instruction and student learning in our own classes, do we sometimes play the same trick? Rather than provide a rich variety of learning activities, do we simply stick with our favorite -- a tried-and-true strategy -- and maybe dress it up a bit by having students answer the odd-numbered questions in the book rather than the even-numbered ones?

If we do that, in essence, we aren't even asking students, "Do you want a snake, an eel, or a worm?"

Could it be that we don't know how to tie the balloons, or that perhaps we just don't have the energy to make them interesting? Heaven forbid that we might be reluctant to make the attempt, yet in many cases, I am afraid that some teachers praise the virtues of snakes, eels, and worms far too much.

The truth is that bookwork, copying notes, listening to lectures, filling in the blanks on

worksheets, and coloring between the lines make up a large portion of the schoolwork in our classrooms. No wonder students are unimpressed when teachers try to engage them in these passive, uninteresting activities. Snakes, eels, and worms are boring!

#### **Engage with Variety and Choice**

Recently, I asked a tenth grade student why he was struggling in school. He explained that it's because school is boring. To be blunt here, when I took five days recently and followed one student each in tenth grade, eleventh grade, twelfth grade all day long through each of their classes, I was bored most of the time. I found it hard to sit still for so long, and I wondered how the students got through it.

I think you get the picture. As teachers, we need to start creating more elephants, giraffes, and swords -- and that awesome Spider-Man.

Let's say it's Monday, and the goal is to get students to read a textbook chapter for content and understanding. As a resource, textbooks have lots of information, but they are not the only source for information and learning.

I'd like to suggest that you offer something like the following selection for your students to choose from:

- Create a slide show presentation to illustrate the major points of the chapter as if they were teachers teaching younger students.
- Develop a newspaper article or a journalistic TV report about the chapter as if it were breaking news.
- Prepare a debate on the chapter's main points and pose as either politicians or lawyers presenting their persuasive arguments.
- Write a drama about the contents of the chapter and perform it to their peers and parents.
- Construct an encyclopedic database of vocabulary, terms, and concepts included in the chapter, as well as prior knowledge that needs to be understood, and questions that are yet to be answered.
- Design a virtual field trip to study topics and concepts to be learned based on the content of the chapter.
- Invite experts to visit their classroom and ask them questions about their expertise based on the content of the chapter.
- Use the contents of the chapter to devise an experiment to prove or disprove the assertions made in the chapter.
- Fill the walls of the classroom with essential questions gleaned from the chapter and challenge the teacher and other classes to a content quiz show.



In each of these options, not once is it necessary for the teacher to say, "Open your books to page 37 and answer the questions at the end of the chapter." We want the students to love the content as much as we do, not to hate it. If we can get them to love it, then they will continue to learn.

Just as I saw the children's faces light up on the Fourth of July when they saw the balloons transformed into flowers or Spider-Man, I have seen students light up when the teacher takes a passive activity and makes it an active one.

#### 4. USE QUESTION EFFECTIVELY

For those who use lecture as the primary delivery method in the classroom, there are a few relatively easy methods to increase student involvement and interest in the classroom, regardless of course level or academic field. At the simplest level, this approach requires asking questions during the lecture that challenge students to apply the concepts and principles introduced. Although most instructors would maintain that their students already ask questions during class, some college professors still devote only a small portion of class time to posing questions to students. Most of these questions are directed at the lowest cognitive level, requiring only recapitulation, clarification, or factual responses. Often only a small proportion of students regularly respond.

Appropriate questioning in an active learning can fulfill a number of different functions (Brown, 2001:169-171):

- a. Teacher questions give students the impetus and opportunity to produce language comfortably without having to risk initiating language themselves. Appropriately pitched questions can give more silent students an affective "green light" and a structured opportunity to communicate in their target language.
- b. Teacher questions can serve to initiate a chain reaction of student interaction among them. One question may be all that is needed to start a discussion; without initial question, however, students will be reluctant to initiate the process.
- c. Teacher questions give the teacher immediate feedback about student comprehension. After posing a question, a teacher can use student response to diagnose linguistic or content difficulties, grammatical or phonological problems.
- d. Teacher questions provide students with opportunities to find out what they think by hearing what they say. In responding to questions about a reading or a film, they can discover what their opinions and reactions are.

This self discovery can be especially useful for a pre writing activities.

Certain types of questions may actually discourage active learning. Beware of the following questions (adapted from Kinsella 1991):

- a. Too much class time spent on display questions-students can easily grow weary or tired of artificial context that do not involve genuine seeking information.
- b. A question that insults students' intelligence by being so obvious that students will think it's too silly to bother answering.
- c. Vague questions that are worded in abstract or ambiguous language
- d. Questions stated in language that is too complex or too wordy for aural comprehension.
- e. Too many rhetorical questions (that you intend to answer yourself) that students think you want them to answer, and then get confused when you supply the answer.
- f. Random question that do not fall into logical. Well-planned sequence, sending students' thought patterns into chaos.

#### 5. MAKE CONNECTIONS

- a. Direct Relationship: Problems Lead to Creativity ( $P \rightarrow C$ )

Here, problems can directly influence the content or process of creativity. Kay Jamison, in *An Unquiet Mind*, wrote about her own bipolar disorder. The content came directly from her experience. The process might at times have been affected by mild mood symptoms affecting cognition, affect, or motivation (e.g., looser associations, deeper feelings, enhanced energy or motivation). As another example, consider a young woman who just escaped an abusive situation and immediately and creatively helps a sibling escape.

- b. Indirect Relationship: Problems Lead to a Situation  
(Third Factor) That Leads to Creativity  
( $P \rightarrow T \rightarrow C$ )

Here problems lead to an event or realization (Third Factor) that generates new creative goals or accomplishments. Consider someone who got painfully divorced and is writing regularly in a journal, for catharsis and understanding. This individual discovers hidden potential, pleasure from writing, and the wish to share with others around more universal themes – and comes to write a blog that helps many people. Nobelist John Cheever is another example, who wrote as a youth about family and school difficulties, and later in life shared some of this more broadly in his books.

With growth beyond personal issues and greater concern for the human condition, these examples also concern deficiency creativity turning into a more altruistic being creativity (Rhodes, 1990).

c. Direct Relationship: Creativity Leads to Problems ( $C \rightarrow P$ )

This one can go either way. Problems are almost guaranteed for some types of creativity, such as visual art or writing therapies that open up hidden recesses and reveal unconscious material. Often we seek this in arts, in psychotherapy, in dream work, or in talking with a friend. But what happens next? Why is one person resilient (Flach, 1990), coping with personal disruption and reintegration, while another is not? Humanistic psychologist Rollo May (1975) wrote about anxiety that can accompany creative revelations and the need for courage to move ahead with creativity. Difficult results of one's creativity may ultimately be healthy, if worked through (as in the preceding section). If not this can lead to escapes and various problems, as one sees in the section that follows.

d. Indirect Relationship: Creativity Leads to a Situation

(Third Factor) That Ends Up Generating Problems ( $C \rightarrow T \rightarrow P$ )

Here a problem becomes too much, even if resilient attempts were made to cope (or defend). Unlike the Penebaker (1995) studies where expressive writing participants worked things through toward increased well-being, here major discomfort remains untreated. This could lead to depression, alcohol or drug abuse, avoidance, etc. Another sad case involves ostracism of creative you thin schools, by peers, and sometime by teachers whom are understand their presentations (Cramond, 2005). They may cope by withdrawal, clowning, and other defenses, as may some employees in similar situations.

e. Third Factor, Which Can Affect Both Creativity and Problems ( $C \leftarrow T \rightarrow P$ )

Familial liability or a diathesis for bipolar-spectrum mood disorders affects perhaps more than 5% of the population (Akiskal & Akiskal, 2007; Akiskal & Mallya, 1987). (Consider too other major Pathologies that run in families and might show a compensatory advantage.) Enhanced creative potential isn't necessarily related to degree of illness, or even to illness at all just to underlying familial risk. There may be effects on cognition, affect, or motivation. It may even follow (e.g., Richards & Kinney, 1990) that early creative exposures for children at risk could lower the emergence or expression of pathology. Other

examples include many early childhood conflicts. These can at times lead to resilient coping (e.g., Goertzel & Goertzel, 1962; Werner & Smith, 2001), at other times to decompensation. It is vital to clarify what makes the difference, and how one can intervene to help people.

## SUMMARY

Although everyday creativity may require much of us in terms of personal risk-taking, there are many indications that it can be healthy in expressive arts activities and beyond. Although one hears about "creativity and psychopathology," creativity may serve as a healthy compensatory advantage to the risk for bipolar disorder and perhaps for schizophrenia. We also have chances for resilient creative coping with our problems. The next section looks more deeply at what may be happening personally during insightful creative moments.

## References

- Bandura, A. (1997). *Self-efficacy: The exercise of control*. New York: W. H. Freeman & Co.
- Branden, N. (1994). *The six pillars of self-esteem*. New York: Bantam.
- Tracy, Brian (1993) *Maximum Achievement*, Simon & Schuster, New York
- Goleman, Daniel (1998) *Working with Emotional Intelligence*, Bloomsbury, London
- Goleman, Daniel, Boyatzis, Richard and McKee, Annie (2002) *The New Leaders*, Little, Brown, London
- Helmstetter, Shad (1998) *What to Say when You Talk to Yourself*, Thorsons, London
- Johnson, B. (2012) "Live Up your classroom with choices" fresh articles blog
- Jamison, K.R. (1989). *Mood disorders and patterns of creativity in British artists and writers*. *Psychiatry*, 52, 125–134.
- Rhodes, C. (1990). *Growth from deficiency creativity to being creativity*. *Creativity Research Journal*, 3(4), 287–299.
- Flach, F. (1990). *Disorders of the path ways involved in the creative process*. *Creativity Research Journal*, 3, 158–165.
- May, R. (1975). *The courage to create*. New York: Bantam Books
- Penebaker, J. (Ed.). (1995). *Emotion, disclosure, and health*. Washington, DC: American Psychological Association.
- Cramond, B. (2005). *Fostering creativity in gifted students*. Waco, TX: Prufrock Press.
- Akiskal, H.S., & Akiskal, K.K. (2007). In search of Aristotle: Temperament, human nature,

- melancholia, creativity and eminence. *Journal of Affective Disorders*, 100, 1–6.
- Akiskal, H.S., & Mallya, G. (1987). *Criteria for the “soft” bipolar spectrum: Treatment implications*. *Psychopharmacology Bulletin*, 23, 67.
- Richards, R., & Kinney, D.K. (1990). *Mood swings and creativity*. *Creativity Research Journal*, 3, 203–218.
- Goertzel, V., & Goertzel, M. (1962). *Cradles of eminence*. Boston: Little, Brown.
- Werner, E.E., & Smith, R.S. (2001). *Journeys from childhood to mid life: Risk, resilience, and recovery*. Ithaca, NY: Cornell University Press.
- Brown, H. Douglas. *Teaching by principle: an interactive approach to language pedagogy*. San Francisco University. New York. 2000
- Thorne, Kaye (2003) *Managing the Mavericks*, Spiro Publishing, London.
- Fowler, H.W. and Fowler, F.G. (1995) *Concise Oxford Dictionary*, 9th edn, Oxford University Press, Oxford.

## THE VALUE EDUCATION LEARNING IN FORMING CHILDREN BEHAVIOR, AGE 5-6 YEARS OLD

Rohimi Zamzam

### **Abstract**

*The purpose of this research is know the Value education learning in forming children behavior, age 5-6 years old. This research was held in TK QatrunnadaCentral of Java, which has 51 students of 5-6 years old. Has ttwo groups that consist of 17 students: the first groups consists of 20 students; and 14 studenst for the second group, and supervised with 6 taechers, administration and cooperation worker. All members of the school community were research informant.*

*The result of the research shows that : (1) Value Education Learning will from a good and prased behavior based on Islamic approach; (2)Value Education Learning that's using by the teachers is concicting of the actuation, assessment, media, and a variation method with a united leraning approach.*

**Keywords:** *Value Education Learning, Forming Children Behavior*

### **A. PRELIMINARY**

Education in Indonesia in general aims to development potential students to become a man of faith and fear of God Almighty, noble, healthy, knowledgeable, skilled, creative, independent and become citizens of a democratic and responsible. Referring to the educational purposes of the above, it is clear that the purpose of education is already showing perfection. That's because the purpose of education is not just one aspect touched ( eg cognitive ) aspects, but overall it's good cognitive, affective and psychomotor. With the perfect educational purposes, public education as the user expects that educational outcomes can realize the complete man, the man who balanced between cognitive, affective and psychomotor.

However it turns out the educational goals by Numan Somantri no explanation of the functional relationship between the domains intraceptive extraceptive knowledge and knowledge), so that the position is in juxtaposition or in parallel. This is because between them have a very sensitive issue because it contains elements of culture that private faith and devotion to the elements of culture that are considered public. The absence of an

explanation of connectedness between these domains, create educational outcomes feels no lameness. Lameness was strongly felt by the community that the behavior and actions demonstrated by the graduate students of the school. They tend to be only good at cognitive aspects, but less good at affective and psychomotor aspects. As a result of that, many of the school leavers who are good in expressing ideas and concepts but not good in action and deed. Returns to education have been characterized by the formation of the cognitive but affective aspects of the formation and ultimately the behavior was much like respect for parents, teachers, children less adherent, daily attitude shown as : greet, shake hands, and this is caused due to the imbalance of interpretation purposes education. Society at the present time tend to have a misconception about the success of an education that success was demonstrated by the achievement of high grades. Furthermore they perceive that it is not clear educational outcomes, unpredictable linearly from now. Not what graduates should be able to nurture a vision for the future. As noted Singh "future time is the dimension of existence ", and thus it is expected that education is supposed to be able to grow the vision of a child 's ability to face the future. This is because the future is not a single thing, and for a future not only one straight path, but many roads leading to the various possibilities that can occur. Of course in foster good behavior should begin early age children, so there is a basic foundation when as an adult. In this regard it should be required to provide education value can create multi-dimensional stimuli in children's learning activities both on the cognitive, affective and psychomotor domains which is ultimately going to establish good behavior. Such mechanisms will be able to react to external stimuli that would foster creativity and systematic, that is able to grow alternative vision. Mexicans Abroad suggests that this kind of stimulus is needed since the age of children in the first three years to grow the system penserabutan their brain nerve system. Say so because at this age is a critical age.

## B. DISCUSSION

### 1. Behaviour

Behaviour is any form of reaction or response to a person to an object that is realized in action or movement. This behavior occurs because of the tendency or urge a person to meet their needs, and seek pleasure or avoid pain. Hull was quoted as saying by Gredler mention that behavior or behavior serves to keep the organism can still survive. Understanding behavior is also an act or manner by individuals, either without demonstrated and shown to the environment. Actions or ways in which a person without is shown to the environment, such as frowning, style (style) in writing, dancing, and smiling.

#### Childhood Behavior Characteristics 5-6 years

To look specifically at the behavioral characteristics of children aged 5-6 years, according to Jean R. Fewldman can be seen from several aspects :

- a. Physical Aspects(a) Can run, jump, spin, kick and catch the ball, and lined up like soldiersontiptoe;(b) to write the name, cut the rope, draw simple, copy simple drawings, fine motor already well controlled;(c) to wear their own clothes, sewing, cutting, tying shoelaces, hair combing and can take care of themselves.
- b. AspectsofLanguage(a) Glad to be funny, strong interest in the words ;(b) Glad to throw the words why and how;(c) to follow the song, game, pat and others ;(d) Be able to communicate well ;(e) to provide your name, complete home address, telephone number, and date of birth ;(f) Liked the book, can retell the story or compose a story part series.
- c. Aspects of Intelligence(a) Having a curiosity about the outside environment ;(b) to make a three- dimensional building, know the names of the form ;(c) Start of letters and numbers, can recognize letters and sounds ;(d) to the concentration in a long period of time ;(e) to draw up to 10 numbers and counting with objects ;(f) Can count to 20, recognize the position, and said opponents were ableto concentrations much longer.
- d. Social Aspects(a) dear friends, can work together and share toys ;(b) to express their feelings, sometimes behave out of control;(c) Cooperate with the group and can follow the rules ;(d) The game will further explore the potential of imagination ;(e) Very eager to please adults.
- e. Emotional aspects(a) Shows the extreme emotions/emotional, occasionally pity but sometimes hate ;(b) shows hostility, defying

very sure of herself and love adventure ;(c) have a high imagination, identity begins to form, comes a sense of pride in their work ;(d) appears the feeling of giving and receiving ;(e) very angry when unable to do anything he wants.

Formation behavior is inseparable from the cognitive maturity and child affective domain. While efforts mefungsikan cognitive maturity depends on the stimulus he received from the environment. Families are the first and the environment closest to the formation of the child's behavior, it becomes very important as a basis for its existence in the form of behavior.

### 2. Educational Value

- a. SubstanceArthur W. Combos are the essence of education suggests the following values :1) That the mere intellectual learning can generate destructive excesses ; 2) the value of education is very necessary to develop the potential of emotion and feeling ; 3) That the brain not only serves asthe store of facts and concepts;4) That the learning is the process:(a) internalization and personalization information and moral values ;(b) an exposure to new experiences informations ;(c) personal discovery of what it means ;(d) Determine the ways of behavior ;(e) the establishment of self- concept, values, feeling of challence and the feeling of being bellonging and care.Value of education as a way to address or point of view is the basis or rationale on which to base or the base of starting engineering implementation. In determining the choice of approach, as well as the expectations of the target mindset and philosophy of the person or people in question was crucial. When determining the choice of approach, benchmark that should be used is the moral values and norms of Pancasila, cultural and religious communities.
- b. Characteristics of Educational Value  
There are a number of characteristics that can be recognized in the value of education, namely:1) affective world is part of the totality of the human self (internal) and the external world ;2) the problem is the value of coaching coaching psychiatric problems, therefore postulatnya to be understood ;3) the value of the educational process can only occur if the theory or principle on this matter can be understood and applied since the program planning activities through a pattern of teaching and assessment as learning activities ;4) the value of the education process requires a number of prerequisite readiness and openness and the ability afektual students, the

atmosphere and environment of learning, understanding and capabilities as well as a private teacher and procedural patterns ;5) The success of the process and outcomes of learning activities depends on the clarity of educational value expectancy, value targets that must be personalized and moral clarity of instructional materials as well as the reliability and affordability of learning media ;6) the professional skills of teachers to package the message content, as well as proficiency to zoom to invite and engage potential students afektual ;7) the understanding and application of the various principles of humanistic education, among others ;8) goals and learning patterns must be whole - round value (substance and potential targets) continuous between taxonomic domain;9) the target value - moral expectations in accordance with the required curriculum content of the message ;10) must relate learning activities interaction with the environment ;11) fostering moral values as early as possible, gradual, sequential and continuous ;12) is individualized with an integrated process that varies.

c. Principles of Learning Value

Approach or traditional learning models tend to assume that students have the same needs, and learn the same way at the same time, in a quiet classroom, with activities subject matter strictly structured and dominated by the teacher. In fact, the traditional teaching approach or feels difficult to achieve educational goals. Traditional learning models are now widely applied, tends to pay less attention to the continuity of students gained experience in family life. Things like this is contrary to the character of elementary school age. Elementary school students still crave the ongoing experiences in the family environment can also be experienced at school. In addition, the experience of those who are still demanding the implementation of the global nature of learning models that are relevant to their characteristics (Briggs and Fotter, 1990 ; Rachman, 1999). Characteristics of elementary school students are happy to perform manipulative activities, want all concrete, and integrated. Taking into account the characteristics of the students like it, then approach or learning model that assumed suitable for elementary school students are learning models that are based more on social interaction and personal (Joyce and Weil, 1992) or models of interactions and transactions.

### C. COVER

Bother to have fun first and then the proverbial no fade by the progress of time, parents should be the watchword, which from the beginning should have the power to educate their children to be the generation that “qualified”, hardiness, not withered and broken spirit in the face of challenges. As is there as a mature implementation of value education is implemented not run harmoniously and efficiently. Here and there still seems no lameness. As a result, the value of education is expected to form a valuable noble nation has not been reached. Inaccessibility was characterized by the presence of moral crisis of the nation. There fore, in order to succeed with the educational value of good example of the need of all parties: there is good cooperation between parents, educators, and community; no continuity between education held at home, at school and in the community, and learning should be organized by the methods that touch emotional totality. So specifically here summarized that early childhood philosophy is to instill values, norms and morals in children early so as not to lose direction, of course with the debriefing when they are adults, dealing with matters of irregularities, corruption, destruction of morality, vices, the disintegration of the nation, the nature of my better parts, etc., will not hapen, because the child has been equipped with the values, norms, and morals that have been instilled . And of course uswatun hasanah (eg , role model ) is not only limited in the mouth but applied in everyday life. Although they have experienced ups and downs for the first terlbih finally to destination. Currently, heart many Indonesian children who are blind, deaf, lame, and sick, so they are blind terhadap truth and goodness, and then easy to blindly commit acts of violence, be brutal, drug addiction, trapped in the sex trade, and other-other. They become so because they got a sample and belajr of the adults, even public figures who are also behaving like that. We, the educators (teachers and parents) should not allow the present alarming situation becomes even worse. This, children who are within our reach, we must give the value of education, so that they truly become a quality of life. Hopefully we managed to reform ourselves before we reform others. Hopefully with the planting of good values early on sat reap pleasurable results they become adults in letter life.

**References**

- Djahiri, Kosasaih., 1992. *Affective World Menuluri for Moral Values and Moral Education*. New York: LPPMP.
- Glenn, Paul J. 1934. *Ethics ; A Clas Manual in Moral Phylosophy*. St.Louis & London; B.Herder Book Co.
- Haricahyono, Cheppy., 1995. *Dimensions of Moral Education*. Semarang, Semarang Teachers' Training College Press.
- Hers. Richard H. et al., 1980. *Models of Moral Education: An Appraisal*. New York: Longman Inc.
- Purwa Hadiwardoyo, A1. 1990. *Moral and Masaalahnya*. Yogyakarta, Issues, Yogyakarta Canisius
- Sinolungan, A.E. 1997. *Developmental Psychology Students*. Jakarta :Wira Sari

## INITIATING CULTURAL-BASED CHARACTER LEARNING IN PRIMARY SCHOOL

**Masrukhi**  
Semarang State University

### **Abstract**

*Each nation will recognize the importance of character building in order to preserve and maintain its existence as a nation-state. The most strategic vehicle for character building process is education in schools, through the learning process in class. By taking a learning setting of Citizenship Education (PKn) in primary schools in Semarang, empirical studies which have conducted find a few things. Firstly, configuration model that was built of the latent exogenous variables, such as appreciation of teachers, principal leadership, school culture, learning design, and the latent endogenous variable; learning of character-building indicate that the model fit, based on the findings of Chi-Square value of 23.22 and its p-value of 0.0871. Secondly, the learning of character-building more awakened by the school culture and leadership of school principals.*

*This study recommends several ways. First, it is necessary to increase the understanding of PKn elementary school teachers about Character Development through synergy activities between education department as a facilitator, universities as a material developer, by empowering and developing the existing institutions at the community of primary school teachers as Teacher Working Group (KKG), profession organizations, and so on. Second, it is necessary to facilitate the arrangement of examples or models of Citizenship Education learning design which contains Character Building, to teachers in primary schools by involving various stakeholders. Third, it is necessary to do structural approach, empowering principals to facilitate and motivate Citizenship Education teachers of Character Development learning in the classroom, which is done through the meetings of Principals Working Group (KKKS). Fourth, it is necessary to do the empowerment of school culture to support Character Development learning in PKn classroom through the strengthening of extra-curricular activities that can be created and developed by the Citizenship Education teachers by empowering local potentials which contain the noble values, such as traditional games, folklores, fairy tales, poetry, wise words, symbols, etc., which contain local wisdom.*

**Keywords:** *Character building, learning process, school culture*

### **PRELIMINARY**

Character Building is a very fundamental problem of the nation. In Indonesia, the effort to build character development in the context of national character has become a serious problem since the proclamation associated with periods of power consolidation. Herbert Feith stressed, "The Difficulties Which presaged this situation for the process of power consolidation changed from clear if one looks at the character of Indonesia as a political unit examines the divisive forces and growing from its geographical, economic, and socio-cultural organization." (Feith, 1992).

When the later consolidation of power was done, things that confront the nation for the next character development is a matter of social inequality; reality as a multi-ethnic community, multi religious and multi cultural. Bung Karno had asserted in a speech in front of the colonial judge committee in 1930, as follows:

".... To build nationality awareness, in this nationalism, there is a power, which later could open the pleasures of days later. We have a nationalism that must be positive nationalism, creative nationalism, nationalism which established, nationalism that "create and worship". Through the positive nationalism, Indonesian people can establish independent living conditions that are material and mysticism. ( Soekarno, 1930:63)

In fact, by quoting the opinion of the great leader of Egypt at that time; Mustafa Kamal, Bung Karno reaffirmed;

"Because of nationalism, the backward nations could reach quickly the civilization, greatness and power. Only nationalism could be the blood that flows in the veins of strong nations and it could give life to every human being alive" . (Sukarno, 1930).

Post-reform, the Indonesian people crashed tremendous characters. Polite behaviour, tolerance, solidarity, social concerns, mutual cooperation, hard working and , such as attributes of good



citizenship, is replaced by the barbarian culture; suspicion, selfishness, anarchism and so on.

The survey that was conducted by Klaus-Peter Kriegsmann (2003) from the Asian Development Bank, which identified six ASEAN countries of the six indicators; infrastructure, legal system, political stability, respect for intellectual property, the level of transparency and corporate governance, Indonesia was the country's most low credibility, after Vietnam, Philippines, Thailand, Malaysia and the highest is Singapore.

The low credibility of Indonesia in the eyes of the international world is a reflection of the behaviour of individuals who has no characters, so the negative impact on the state management, corporations, legal systems, which ultimately will reduce the competitiveness of Indonesia, and cause Indonesia more slumped socially, economically and culturally.

The importance of character in the existence of the nation, expressed also by Davidson and Rees-Mog (1997) as follows:

*"All strong societies have a strong character basis. Any study of history of economic development shows the close relationship between moral and economic factors. Countries and groups that achieve successful development do so partly because they have an ethic that encourages the economic virtues of self-reliance, hard work, family and social responsibility, high savings, and honesty."*

Lickona, a professor of education from Cortland University described the relationship between aspects of character and the progress of the nation. According Lickona (2003), there are ten signs of the times to watch out because if those signs already exists, it means that a nation is heading to face destruction. Those signs are: (1) increasing violence among adolescents, (2) use of language and words are deteriorating, (3) strong influence of peer group in the act of violence, (4) increasing self-destructive behaviour, such as the use of drugs, alcohol and free sex, (5) the more blurred the moral guidelines of good and bad, (6) declining work ethic, (7) low respect for parents and teachers, (8) low sense of individual responsibility and citizenship, (9) used to be dishonesty, and (10) the existence of mutual suspicion and hatred among fellow.

It was surprising that the indications of the young generation behaviour are already a common direction. A research conducted by Megawangi (2007) found those behaviour, such as increasing violence among adolescents, the use of language and words are deteriorating, the strong influence of

peer group in violence, the phenomenon of increasing self-destructive behaviour, the more blurred the moral guidelines good and bad with the indications do not feel guilty when lying and there is no sense of empathy, declining work ethic among the young generation, increasingly low level of respect for parents and teachers, the phenomenon of low sense of individual and citizen responsibility, used to be dishonest among young generation and the presence of mutual suspicions and hatred among them.

As subjects in school are on a mission of smart and good citizenship, character building is an important mission of the Citizenship Education in schools. Citizenship Education subject directly related to the inculcation of values. In fact, this subject has an internalization responsibility of character building value which is bigger than other subject matter. With jargon Civic Intelligence, PKn expect to construct the learners to have a sense of citizenship in the life of nation and motherland. Civic Intelligence becomes weak when ignoring character development in it.

Associated with the internalization of building character early, then the process of learning in primary schools is very important. This process is a vehicle for initial enlightenment effort that will shape the cognitive structure of learners about the characters. Elementary school-age children still think a simple and concrete. Their world is still limited to their playing and family environment. The process of imitation is dominant for the efforts of values internalization.

Donna E. Norton, as quoted by Sunarto (2000) shows the results of his research that the views of cognitive development, a child will begin learning to read and enjoy simple books and demonstrate the new capabilities at the age of six to eight years. Then at the age of 10 to 12 years, children begin to develop strong linkages with the social relations more large as expected by the environment.

These conditions are very strategic for character development in the life of the child. In the future, the concepts of character that has been internalized in him will be the parameters for interaction with social phenomena as the result of the social construction of public culture.

Reminding golden age is very strategic for the development of character, learning process in primary schools should put more emphasis on character development, weather as an instructional effect or nurture effect. Citizenship Education whose mission is smart and good citizenship put the development of character as instructional effect which is reflected in the study materials, learning

process, reference of learning that is used, to the evaluation of learning. But in the reality, these substantive issues are not reflected well on study materials and learning process in class.

Tilaar (2003) asserted her anxiety about the teaching of Citizenship Education in primary schools as follows:

*“PPKn (Indonesian Civic Education version) developed by indoctrination, accumulating knowledge which is less meaningful, hegemonic and often being criticized anti-reality. The values of pluralism are neglected. PKN that should be developed as an education to shape the character of the nation, it is ignored. As an education that leads to shape the character, PKN that should implement multicultural education approach (transformation*

*process of the way of life to respect, tolerance for diversity of cultures that live in a plural society), it is also ignored, whereas PKN is indeed the subject of education to accommodate students who come from various political areas, ethnic and different traditions.”*

Research conducted by Masrukhi (2008), found that character development is low on study materials of Citizenship Education in elementary school. By basing ourselves on Cronbach framework in examining the character development problems which consists of beliefs, feelings and actions, Nawangsih found the distribution of content on study materials of Citizenship Education in primary schools as follows:

Table 1. Material Content of Character Building in Elementary School PPKn Books

No	Material of Study	Content of Character Building
1	Unity and integrity of the Nation	73%
2	Norms, laws and regulations	46%
3	Human rights	45%
4	Needs of citizens	30%
5	Constitution of the State	15%
6	Power and politics	12%
7	Five principles (Pancasila)	13%
8	Globalization	8%
	Total average	30.25%

Masrukhi's research finding as presented in the table above is the real situation in the reality that the study materials of Citizenship education in the Elementary School has a low content of character building.

While the portrait of Citizenship education learning in Elementary schools, the research results of Saefudin (2007) that by using qualitative analysis found the following these things. First, the methods used by teachers in the learning process of Citizenship education in primary schools more focused on the mastery of knowledge, memorization and tasks construction. Second, the subject materials are textbook-oriented which means that learning resources are mostly textbooks. Third, the learning atmosphere is more dominant of “one way communication”; teachers take the role as transmitter materials, while learners receive calmly.

Studying about the findings obtained in research conducted by Saefudin indicated that the character development has not been obtained a space proportionally in the learning of Citizenship education. “Information Processing” model of learning where teachers are more dominant position as a transmitter of knowledge through lecture method, memorization and assignments, as well as

textbook-oriented is very difficult to build the learning process of building character. Learning of character building is a learning process that allows meaningful educational interactions, involving the deepest aspects that exist at the learners themselves. The learning requires the maximal support of the elements, such as good teaching materials, methods, teacher behaviours, as well as support the school environment.

The next problem is the determinant factors that influence the management of Citizenship Education learning as a developer of character. Then the next one is how to make an accurate model to build teaching/ learning process of Citizenship Education in schools as a builder of character.

#### THEORETICAL BASIS

Two theories which are used to conduct an assessment of this issue are Gestalt theory of learning and constructivism learning theory.

Gestalt theory of learning is in the thicket of cognitive learning. Cognitive learning has contributed to the use of cognitive or mental element in the learning process, because its views are firmly that learning is not only mechanistic

stimulus and response, but also involves mental activity within individuals who are currently studying. Therefore, according to cognitive learning theory, learning is an active mental process to achieve, remember and use knowledge. So that, human behaviour cannot be measured and observed without involving the mental processes, such as motivation, intent, beliefs, etc.

Even Gestalt theory assesses visual-motor functions for the behaviour observation. *"Assessment of visual-motor functions is the Importance of a comprehensive psychological evaluation. The Bender-Gestalt test has provided insight into problems as mental retardation, learning disabilities, personality dynamics and brain injury (Decker, 2008).*

The figures who join to construct this theory are Max Wertheimer, Wolfgang Kohler and Kurt Koffka. They have not felt satisfied with the findings of previous scholars who claimed that learning is as a process of stimuli and responses as well as humans are mechanistic. Their researches are more emphasis on perception. According to them, human beings are not only men who are able to react if there are stimuli that affect it. But more than that, humans are individual creatures whose spiritual and carnal. Thus, when humans react to its environment, humans do not just respond, but also includes their different subjectivity elements among them.

Gestalt theory said that learning is a process that is based on understanding (insight). Because, basically, every person's behaviour is always based on cognition; the action whose function are to know and think about the situation in which behaviour occurs. In learning situations, the involvement of someone directly in the learning situation can produce an understanding that can help the individual to solve the problem. In other words, Gestalt theory states that the most important in the learning process is to understand what the individual learned by themselves. Therefore, Gestalt theory of learning is called insight learning theory.

In addition, this study also bases on learning theory constructivism. Despite both being in the cognitivism, this second theory is more existed in the corridor of praxis learning.

Characteristics of constructivism can be observed through the perspective of Mark Windschitl's "dilemma":

*"As more specific phenomena, of interest, "dilemmas" are aspects of teachers' intellectual and lived experiences that prevent theoretical ideals of constructivism from being realized in*

*practice in school setting. For frames of reference are used to describe these dilemmas. Conceptual dilemmas are rooted in teachers' attempts to understand the philosophical, psychological and epistemological underpinnings of constructivism. Pedagogical dilemmas for teachers arise from the more complex approaches to designing curriculum and fashioning learning experiences that constructivism demands. Cultural dilemmas emerge between teacher dilemmas emerge between teachers and students during the radical reorientation of classroom roles and expectations necessary to accommodate the constructivist ethos. Political dilemmas are associated with resistance from various stakeholders in school communities when institutional norm are questioned and routines of privilege and authority are disturbed."*(Windschitl, 2002)

Jean Piaget and Vygotsky stressed that changes of cognitive into development occurs when the existing previous concepts began to shift because there is new information received through the disequilibrium process. In addition, Jean Piaget Vygotsky also emphasized the importance of social environment in the study by stating that the integration capabilities in the group of learning will be able to increase the changes conceptually.

In view of Vygotsky (Elliot, 2003), learning is a process that involves two important elements. First, learning is a biological process as the basic process. Second, learning is a psychosocial process as a higher process and essentially related to the socio-cultural environment. Thus, further Vygotsky, the appearance of a person's behaviour is due to the intervening these two elements. By the time someone gets stimulus and its environment, he is going to use physical senses, such as tools to capture or absorb the stimulus. Then, by using his brain nerves, information that was received had been processed. Sense organ involvement in absorbing stimulation and nerve of the brain in managing the information obtained is the physical psychology process as a basic element in learning.

The second grand theory is packaged of approach system, where school as a place of conducting learning process is placed in a broader spectrum. It means that school cannot be apart from the community. Therefore, learning as a rotating system is also broader. It can happen by considering the interests and expectations of stakeholders in the community. In this context, the relationship between the learning process of Citizenship Education as a character builder that occurs in class cannot be separated with these complex systems. By using the framework of

Makmun systems analysis (as quoted by Widodo, 2005), the complexity of the system will be illustrated as follows.

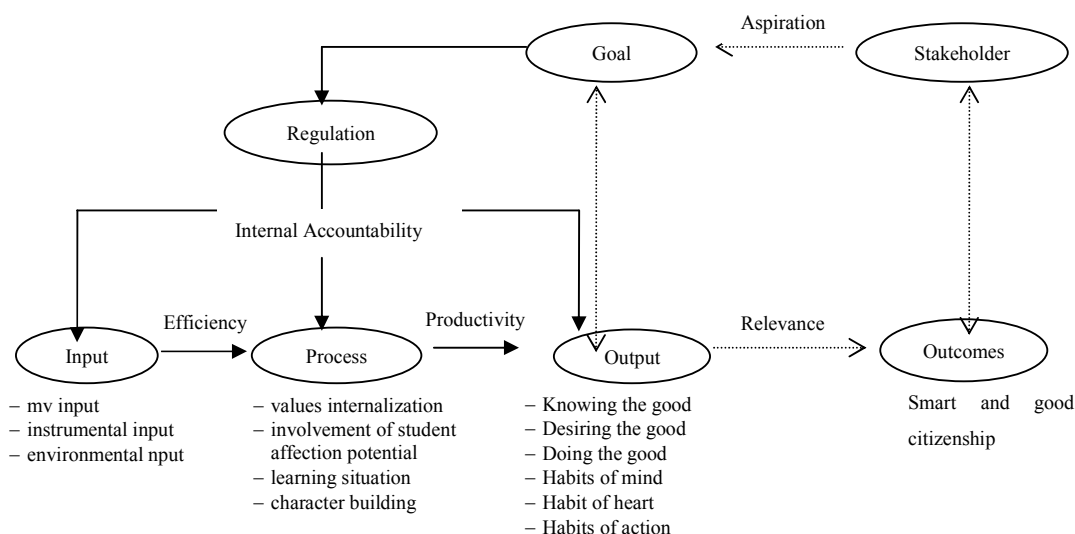


Figure 1. Systems Approach

From the picture above shows that a learning system that includes elements of input, process and output is only part of a system that related to the life society. The result of PKN learning expected by society as stakeholders is forming character of learners to have good attitude and character. Desires and expectations of this society is an aspiration that have to be accommodated by teachers in setting goals of Citizenship Education learning in the classroom as a process of character building. The aspirations of stakeholders are become one of considerations in designing learning about threshold requirements; requirements that have to exist in the learning process of Citizenship Education in the classroom. Threshold requirements are inputs that consist of row input, instrumental inputs and environmental input. Within the process have to realize the internalization values, involvement of affective potential learners, learning

atmosphere of character building, as well as output in the form of learner competence regarding the characters, including indicators of knowing the good, desiring the good, doing the good, habits of the mind, habits of heart and habits of action. Competency of these students eventually lead to the formation of attribute competence "smart and good citizenship" that applied in daily life in society as citizens, and once to answer the expectations of society in which students will reside.

#### EMPIRICAL REALITY OF LEARNING CONFIGURATION

From the data review process, obtained the full model of configuration conceptualization of the influence of a teacher appreciation, principal leadership, school culture, and learning design to the learning of character development, as shown below:

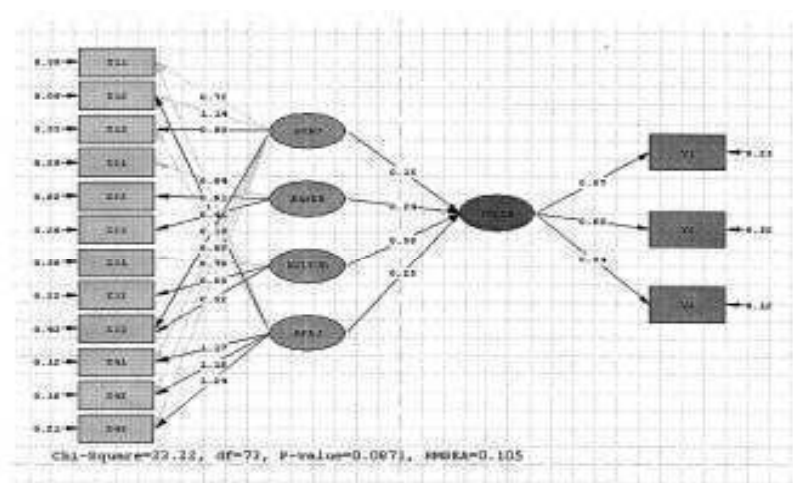


Figure 2. Effect Diagram between Models Full Variable

The output of data analysis if the model will be consulted with the test indicated by the model fit, as follows:

Fit Value Indicator	Coefficient	Interpretation
Chi-Square	52.29	chi square value approaching 0 indicates that model fit.
P Value	0.064	Greater than 0.05 means identical data with the model.

The finding of a full model through the LISREL calculation shows that all exogenous latent variables to support together the formation of learning character development. Variables that provide the highest impact which can be seen from the path coefficient is the school culture reached 0.62, followed by the principle leadership 0.234, the next lesson plan 0.17, and last appreciation for teachers on character development reached 0.05.

Variables that provide the highest impact can be seen from the path coefficient is the school culture reached 0.62, followed by the leadership of ekolah 0.234, next lesson plan 0.17, last appreciation for teachers on character development 0.05.

Learning of character development on the current reality according to the data was influenced

by the school culture and the principal leadership. It means that learning of character development occurs empirically only happen if the school environment and school principle support. Understanding of teachers about the subjects PKn provide character development is still relatively unknown by the teachers. Teachers in the learning PKn just give lessons in accordance with the demands of the curriculum and textbooks which are available in schools. It also has implications for teacher learning design became very weak in providing character development materials.

Despite the full model is fit, but after tests conducted by partial effect of each exogenous latent variable on the endogenous latent variable shows none of the fit configurations. Recapitulation of output shown in the following table:

Table 3. Recapitulation of Partial Test Model

Partial Model	Fit Value Indicators	Coefficient	Interpretation
$\zeta_1 - \eta$	Chi-Square	59.43	chi square value approaching 0 shows that the model fit.
	P Value	0.00	Smaller than 0.05 means that the data not identical to the model.
$\zeta_2 - \eta$	Chi-Square	96.70	Chi square value is far from 0 shows that the model does not fit
	P Value	0.00	Smaller than 0.05 means that the data not identical to the model
$\zeta_3 - \eta$	Chi-Square	59.58	chi square value is far from 0 shows that the model does not fit
	P Value	0.00	Smaller than 0.05 means that the data not identical to the model
$\zeta_4 - \eta$	Chi-Square	36.38	chi square value approaching 0 shows that the model fit
	P Value	0.00	Smaller than 0.05 means that the data not identical to the model

From all calculation results above, every model has not shown that the model is fit yet, because p-value of calculation results are still larger than significant level of 5% (0.05). it means that although all four teachers' appreciation of the exogenous latent variables on character building , leadership of school principals, school culture that supports the development of character design and also having spirit of learning character development have a significant influence on learning character development. However, an empirical appreciation of teachers on character development are still relatively low, the teacher lesson plan has not given the spirit of development characters yet, so that the model of calculation results show that the model is not fully appropriate, learning character development is still possible being influenced by other variables from outside of the model in this research.

Further, modifications made to obtain a model that really fit. The modification is based on indicator of modifications (modification indices) LISREL through viewing coefficients in full model analysis (basic model). Modifications is done by adding a custom indicator variable in the school environment in learning character development (X33). It is the indicator of supporting teacher appreciation in character development. Besides, teacher appreciation indicator variables, namely X1.1: Cognition on character building, X1.2: Affection of character development and X1.3: Cognition regarding the character development are also supporting indicators of character development learning design. Furthermore, the indicator variable X4.1: teaching materials, X4.2: Method of learning and X4.3: instructional media are also supporting indicator of teacher appreciation on character building. The modification result model as shown in the model figure follows.

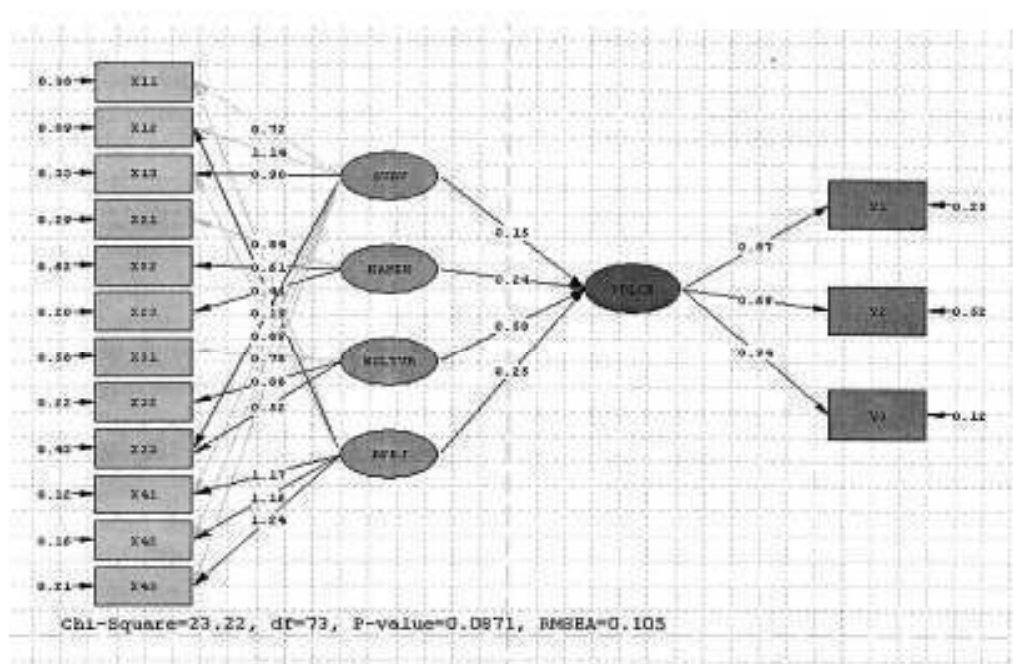


Figure 3. The result of fit model modifications

Diagram of the model in the picture above shows the value of Chi-Square of 23.22 and its p-value of 0.0871. It shows fit numbers because p-value is higher than the significance level 5% (0.05). It also indicates that there is no difference in the results model of analysis modification with an empirical model (Model Fit). From the result of modification obtained standard regression coefficient of teacher appreciation on character development to be increased from 0.05 to 0.07, the standard regression coefficient of the character building lesson plan from 0.17 to 0.25.

An indicator variable of habit in the school environment with learning character development (X33) is the supporting indicator that is big enough for teacher appreciation on character building (0.41).

Indicator of teacher appreciation in the form of cognition about character development is a supporting in learning design of character development and empirical condition show a positive figure of 0.08. Meanwhile, the appreciation of teacher in the form of affection on character development is still relatively weak. It causes the low of character design on character development with the negative standard coefficient. In line with that, the character-building lesson plan in teaching materials, teaching methods and instructional media are also still very weak and very poorly understood by teachers.

Character development learning is a complex totality which requires support from a variety of potential that exists in school. Brook and Gooble (in El Mubarak, 2008) described the complexity which included principles, processes and practices in the learning process. It starts from the values taught had to be manifested in the curriculum which is easily digested and translated by learners in daily life into the school environment that contains its own culture.

Therefore, according to Brook and Gooble (in El Mubarak, 2008), to create learning contents as character development, there are several principles must be adhered. Firstly, school should be viewed as an environment which is like an island with its own culture and language. However, school also needs to expand character education not only to the teachers, staff and students, but also to the family and society. Secondly, in carrying out the curriculum of character, the teaching of values should always relate with the whole school system, the subject is taught as separate-stand alone subject, but integrated into the whole school curriculum and also entire academicians aware and support the teaching values. Thirdly, emphasis is placed to stimulate the learners how to translate these principles into the value of prosaically behaviour.

In the base assumptions, empirically found in this study. Citizenship education learning that brings the character development mission must

obtain the support of various components in the school. By using LISREL analysis as a technique in SEM, indicated that the variables which contribute the highest was 0.62 for the school culture fixation and principle leadership at 0.23.

These facts have implications on teachers' views about learning that learning is not a process of transformation of knowledge, but a process of interaction between all potential learners with education environment (schools) maximally. Through such a process, it will make intensive dialogues, because learners observe, experience, do, and interact with the environment in school. Finally, cognition or internalized values within the learners themselves are the result of the building itself through interaction with the environment.

It is consistent with two theories of learning which are used in this research, the Gestalt learning theory and constructivism learning theory. Gestalt learning theory relies on the functioning of self-insight on students. So, it's often called insight theory (insightful learning). This study confirmed that: first, Insight depends on basic skills. Every individual has a basic capability that different from one to another. The difference usually lies on the age. Usually the young is more difficult to learn with insight. Second, insight depends on relevant of the past experience. Background helped the formation of insight, but does not guarantee the formation of insight. Third, insight depends on the settings of insight situations. Learning insight is only possible if the learning situation is set, so that all aspects required can be observed. Fourth, insight was preceded with a period of searching and experimenting. Individual before solving the problem may make responses that are less relevant to solve the problem. Fifth, the solution for the problem by using insight can be repeated easily and will apply directly. Sixth, it is the most essential part that if the insight had been formed, the problem in other situation can be solved. Insight has the ability to be transferred from one problem to another, although the situation that leads to different insights with the new situation and material, but in same realization and generalization.

Whereas on constructivism learning theory, the important principles in this context are that in the learning process, learners should be active and engage learners into learning centre and in the classroom learning. Therefore, the teacher is a facilitator which facilitates the process by using ways that make information becomes meaningful for students, through attractive methods, media and teaching materials synergistically. Teachers must also provide opportunities for students to find or

apply their own ideas, beside to teach the students to realize and aware of their own learning strategy.

The students need to be familiar to solve problems, find something useful for them, and doing with ideas. Teacher won't be able to guide all knowledge and norms to the students. The students have to construct knowledge and norms in their own mind set. The essence of this constructivism is the ideas. The students have to find and transform certain complex information into other situation. Based on that, teaching and learning have to be in "constructing" process, not only "receiving" knowledge and norms.

### CULTURAL-BASED LEARNING

Building an Indonesian citizenship teacher education which contains character building should explore the headmaster's leadership potency and culture which grows in the school community. Headmaster leadership as a personal manifestation which has structural authority in the research finding which has high correlation, shown by correlation index as 0.58, with learning which contains of character building. The roles of headmaster's leadership are in the modelling, giving motivation, giving facilities, and able to create and to stand the regulations at school. That is way, taking the headmaster's role can be meant as structural approaches.

Besides exploring the headmaster's leadership, the growing and developing culture at school can't be ignored. The correlation between school culture and learning which contains character building has high coefficient that is 0.94.

Exploring the school culture can be done through extracurricular activities that are created and improved by Indonesian citizenship teacher. Goes along with the extracurricular characters, in these activities, the teacher can make any improvements in every occasion because they don't be under the formal curriculum again. Local potency which contains moral value can be added here, traditional games, folklore, fairy tales, prose, wise words, symbols, etc. All those potencies can be arranged into interesting extracurricular activities agenda to the students. That effort can be named as cultural approach.

There are two approaches which are explained above; structural approach and cultural approach must be based on the Pancasila parameter. This can't be apart from a Principle that the effort of character building in Indonesian context is characters which base on Pancasila as the basic value.



The visualization of the synergy between structural approach and cultural approach in the effort of building Indonesian citizenship leaning

which contains character building is as the following:

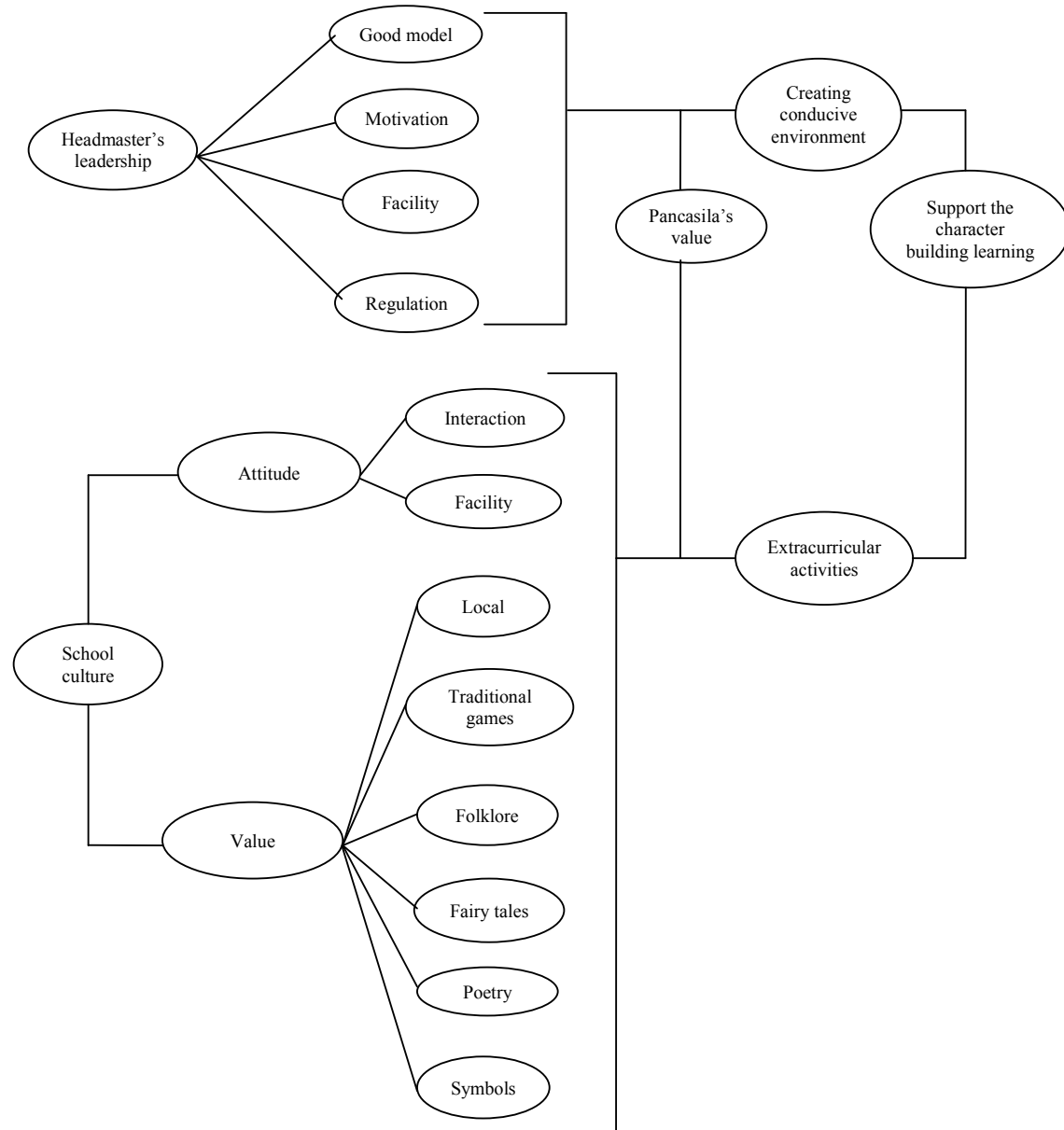


Figure 4.

He is Freire, figure of learning who is very expert in exploring that learning process through beautiful words. In his opinion, the nature of human is being an actor or subject, not an object of the victim. The calling of genuine human is being an aware doer who acts to defeat the world and reality

which crushes him. World and reality are not 'something which appears by itself, and that is way "this should be received as it is", as a fate or destination that can't be avoided. Humans have to be critic and full of creativity to live in the world and reality, and that means humans have to

understand his appearance. Therefore, education has to be self reality introductory oriented, and able to get closer with the environment. (El Mubarak, 2008:75)

Next, Freire mentioned that education process as a human being learning (humanize human) which is an effort to prepare smart and real generations, smart emotionally, smart spiritually, not to create small humans, passive, and can't solve the problems faced.

To apply the learning approaches which base on human being in Citizenship Education, the three social studies learning traditions can be applied. First tradition is the tradition of "*Civic Education Taught as Citizenship Transmission*". This tradition refers to certain social learning method which has aim to improve good citizen, which is signed by "*conforms to certain accepted practices, hold particular beliefs, is loyal to certain values, participates in certain activities, and conforms to norms which are often local in character*" (Barr et.all.,1978:22). Therefore, the aim of this tradition is to develop "a reasoned patriotism; a basic understanding and appreciation of (America) value, institution, and practices: personal identity and integrity and responsible citizenship: understanding and appreciation of the (America heritage, active democratic participation, and awareness of social problems, and desirable) ideas, attitudes, and behavioural skills" (Barr et.ell.,1978:44). In other words, this tradition focuses on developing good citizens both in value and norms which have been accepted formally in a country (Saripudin, 2001:24)

Second is the tradition of "*Civic Education Taught as Reflective Inquiry*", is a learning modus which emphasizes on the same thing, that is developing good citizens which different requirements that is seen from the ability "*.....to engage in a continual process of clarifying process of clarifying their own value structure*" (Barr et. all., 1978:86). Therefore the main purpose of this tradition is "*....the enhancement of the students decision making abilities, for decision making is the most important requirement of citizenship in a political democracy*" (Barr et. All.,1978:102). In other words, this tradition focuses on the development the good citizen characters with its main character is the ability to analyze the social problems and then can take smart decision.

The third tradition is; "*Civic Education Taught as Social Science*". In this tradition, the learning modus is also emphasizes on the development good citizens which is signed with the ability of: "*....mode and thinking from social science disciplines, that this mode of thinking, is*

*generalizable, and having learned he will understand properly, appreciate deeply, infer carefully, and conclude logically* (Barr et.all., 2978:106). It means that this tradition pays more attention in the development efforts of good citizens' characters which are signed by the ability of facing and solving social problems using vision and social scientist way of work.

The three Citizenship Education learning traditions aren't seen black and white, which means if we use one the approach, we leave other approaches. The differentiation of that Citizenship Education orientation is only academically. Practically, synergism between the three traditions will give effective learning impact for the creating good citizens. This is because the indicator of the good citizens are citizens who obey the norms and role of law which grow and develop in the social life (*Tradition of Social Studies Taught as Citizenship Transmission*), citizens who have ability to analyze social problems and then able to make smart decisions (*Tradition of Social Studies Taught as Reflective Inquiry*), and citizens who can seen and solve social and personal problems using visions and social scientist way (*tradition of Social Studies Taught as Social Science*).

## CLOSING

This research finds that school culture and headmaster's leadership give significance contributions to the formation of Citizenship Education learning process which contains character building. School culture gives 33.64% while headmaster's leadership gives 5.76%. These research findings bring implication that the formation of Citizenship Education learning process which contains character building to its students should be started by creating conducive school situations. The two things which have to be created are school culture and headmaster's leadership. Even though those two variables don't have direct connection to the class learning process, however, the value investment is not only happens in the classroom. The formation of school culture and headmaster's leadership can be achieved when it is supported by all related sides. From policy aspect, support from Education Department, from mentality and material are needed from university over there.

The second finding of this research is that in the elementary school's Citizenship Education management, characters building is a synergic effort, in some aspects, from the teacher's appreciation, school culture, headmaster's leadership, and teaching design. This finding gives

implication that the effort of enlighten to all participants from all potencies at school about characters building needs to be done with well planned, systematic, and cohesive by involving all character building experts, supported by the decision maker that are headmaster and education department.

Modification of fit model is shown that teacher's appreciation indicator which forms a cognition about the character building is a support in the teaching design which contains character building at empiric situation shows positive point of 0.08, meanwhile, the teacher's appreciation which is as an affection of creating characters building and conation about characters building is still low enough which becomes one of the causes of the minimal level teaching design which consists of character building with negative standard coefficient. In line with that, teaching design which contains character building in the teaching materials, teaching methods, and teaching media is also still weak and the teachers don't understand well. Implication of this finding is that there is still an important role of the teacher in the teaching process which contains character building. Therefore, the teaching of Citizenship Education teachers about character building should be done well planned and systematic started from the changing of the structural cognition of teachers of the importance of character building to the effort of changing teachers' *mindset* about character building.

## CONCLUSION

Rearrange the Citizenship Education learning to be learning which contains character building; it needs good planning by exploring all potencies through a strong system. In this context, the effort of the betterment of Citizenship Education which contains character building quality is done by education management approaches, which one of those is school learning management. In the context of education management, it needs to arrange Citizenship Education management guidance as a school cultural-based character building.

## Reference

- Barr, R. D., Barth, J. L., Shermis, S.S. 1977. *Defining the Social Studies*. Virginia: National Council for the Social Studies.
- Decker, Scott L. 2008. *Measuring Growth and Decline in Visual-Motor Processes with the Bender-Gestalt* Second Edition, page 3, Journal of Psycho educational Assessment. Published by Sage.
- <http://www.sagepublications.com> (14 Desember 2008).
- Elliot, S.N. 2003. *Educational Psychology; Effective Teaching- Effective Learning*. Singapore: Mc Graw-Hill Book.
- El Mubarak, Zaim. 2008. *Membumikan Pendidikan Nilai; Mengumpulkan yang Terserak, Menyambung yang Terputus dan Menyatukan yang Tercerai*. Bandung: Penerbit Alfabeta.
- Feith, Herbert. 1992. *The Decline of Construction Democracy in Indonesia*. Ithaca, New York: Cornell University Press.
- Lickona, Thomas. 2003. *My Thoughts about National Character*. Ithaca and London: Cornell University Press.
- Megawangi, Ratna. 2004. *Pendidikan Karakter: Solusi yang Tepat Untuk Membangun Bangsa*. Jakarta : Star Energy.
- Masrukhi. 2001. *Pemanfaatan Media dalam Pembelajaran PPKn di SMU di Kota Semarang*, hasil penelitian, tidak diterbitkan. Unnes : Lembaga Penelitian Unnes.
- Soekarno. (1930). *Indonesia Menggugat Pidato Pembelaan Bung Karno; Dimuka Hakim Kolonial Tahun 1930*. Jakarta: Departemen Penerangan RI.
- Sunarto. 2000. *Analisis Wacana, Ideologi Jender Media Anak-anak*. Semarang: Mimbar.
- Saefudin, Asikin. 2007. *Pelaksanaan Pembelajaran Mata Pelajaran Pendidikan Kewarganegaraan di Sekolah Dasar pada beberapa kota/kabupaten di Jawa Tengah*. Hasil Penelitian. Jakarta: Balitbang Dikti. [http://www.dediknas.go.id/jurnal\\_no\\_17/Pembelajaran.htm](http://www.dediknas.go.id/jurnal_no_17/Pembelajaran.htm).
- Tilaar, HAR,. 1997. *Multikulturalisme, tantangan-tantangan global masa depan dalam transformasi pendidikan nasional*. Jakarta: Gramedia.
- Windschitl, Mark. 2002. *Framing Constructivism in Practice as the Negotiation of Dilemmas; An Analysis of the Conceptual, Pedagogical, Cultural, and Political Challenges Facing Teachers*, page 132, Review of Educational Research, Published by Sage. <http://www.sagepublications.com> (14 Desember 2008).
- Widodo, Joko. 2005. *Perencanaan Pendidikan di Sekolah Menengah Kejuruan; Model Perencanaan Pendidikan Berorientasi Keunggulan Mutu Lulusan Berdasarkan Studi Kasus di SMK Negeri 2, SMK Negeri 6, dan SMK Negeri 7 Semarang*. Disertasi, tidak dipublikasikan. Bandung: Program Pasca Sarjana Universitas Pendidikan Indonesia.

Proceedings of International Conference  
On Education, Technology and Science 2013  
Purwokerto, December 28<sup>th</sup>, 2013

Winataputra, U.S. 1999a. *Civic Education  
Classroom as A Laboratory for  
Democracy*. Bandung: CISED.

## INFORMATION AND COMMUNICATION TECHNOLOGY IN TEACHING AND LEARNING IN HIGHER EDUCATION: AN INCONCLUSIVE FINDINGS

**Meika Kurnia Puji Rahayu D.A.**  
University of Muhammadiyah Yogyakarta  
Charles Darwin University

### **Abstract**

*Information and Communication Technology (ICT) has emerged as one of drivers that have significant impacts on organizational changes. Higher education institutions are not exempt from this global trend. The daily lives of faculty, as well as students and staff, are significantly affected by the introduction and dissemination of ICT. However, research findings show mix-results of ICT use in tertiary education. Rather than improve the quality of teaching and learning, the use of ICT in higher education has led to several problems that need to be addressed. This paper provides brief description about those inconsistency findings and discusses several factors that potentially impact the use of ICT in higher education. Further agendas need to be established to minimize the inconsistency impact of ICT use in higher education, in teaching and learning in particular.*

**Keywords:** ICT, teaching, learning, higher education

### **INTRODUCTION**

Information and Communication Technology (ICT) has emerged as one of drivers that have significant impacts on organizational changes (Friga, Bettis & Sullivan 2003; Schoemaker 2008). ICT now has been extending beyond the integration of hardware and software. It involves human resources and managerial activities embedded in the utilization of ICT (Jimba 1999; Ryssel, Ritter & Gemünden 2004; Sandery 1999; Seels & Richey 1994; UNESCO 2003).

Powell and Dent-Micallef (1997) stated that ICT is a catalyst for modernising and improving business performance. ICT also plays an important role in developing effective and efficient information building in businesses and organizations in general (Bhatt et al. 2010; Dhar & Sundararajan 2007). In addition, ICT allows businesses to generate and disseminate information that enable businesses give accurate and creative responses to markets and customer demands. Furthermore, ICT also become enabler for businesses to create value to improve their

competitive advantages (Ali 2004; Bhatt et al. 2010; Powell & Dent-Micallef 1997; Yuhetty 2002).

Higher education institutions are not exempt from this global trend. The daily lives of faculty, as well as students and staff, are significantly affected by the introduction and dissemination of ICT. For instance, communication channels between lecturers and students can be conducted in many ways, at any time. Online resources, including e-journals and e-books, simplify the research processes (Hudson 2010). The management of students, particularly in large classes is modernized through online enrolment, course rosters, and online grade management (Lane 2008). In addition, the use of presentation software such as PowerPoint that is already widely used in lecture classes is completed by the development of Course Web sites, whether stand-alone or as part of a Learning Management System (LMS).

### **INFORMATION AND COMMUNICATION TECHNOLOGY TERMINOLOGY**

Historically, the concept of educational technology underpins the terminology used in information technology. Educational technology includes any tool can be used to help students accomplish specified learning goals (Davies, Sprague & New 2008). Bates and Poole (2003) confirmed that the tools are any means can be used to communicate with learners other than using face-to face. Nowadays, educational technology terminology has shifted to information technology, communication technology, or information and communication technology. In practice, those three terminologies are interchangeably used.

Information and Communication Technology (ICT) is a terms that is now in popular use, generally to describe computer and communications technologies which are designed and used to gather, store, process and display information (Sandery 1999). ICT is an integration of hardware and software which is used in the creation, acquisition, storage, diffusion, retrieval, manipulation and transmission of information (Jimba 1999; Ryssel, Ritter & Gemünden 2004;

UNESCO 2003). ICT includes all equipment and devices of communication network such as, telephone system, television, radio, mobile telephone networks, computers, the Internet, and web-based devices (Shaw 2010). In addition, Seels and Richey (1994) argue that other than the convergence of hardware and software, ICT also includes a range of personnel, resources, and a set of management activities committed to supporting the utilization of abundant capabilities offered by ICT.

### **ICT USE IN HIGHER EDUCATION INSTITUTIONS**

Initially, the tertiary education mainly use ICT to perform administrative task and data storage including admission, registration, and student's records (Gray, Thomas & Lewis 2010; Mills 2008). The shift from manual and paper-based processes to online and electronic processes in administrative office has given a significant effect to staff in accomplishing their tasks more successfully (Coyne 2010). ICT, including e-mail, cell and desk phones, video, and teleconferencing communications technology help administrative staff to communicate more effectively with students (Young 2012). Moreover, with the popularisation of the Internet, ICT became one of the multiple resources that are widely available for academic staff and students in accessing information (Lowerison et al. 2006). Therefore, management and administrative processes in higher education now take place almost completely online using ICT resources (Mills 2008, p. 21).

The ICT use in educational sector in daily basis has also changed the way educators deliver the courses. The introduction of the World Wide Web (WWW) in 1991 has changed lecturers' role. They are not longer a single source who gives information and knowledge to students (Thomas 2011). Moreover, currently, lecturers are facing students who are grown up in a digital world and have their own styles of learning. The characteristics of this new generation of students are including lives surrounded by and using computers, videogames, digital music players, video cams, cell phones, and all the other toys and tools of the digital age (Prensky 2001, p. 3). They use media-based languages and prefer to perform several tasks at once (Sánchez et al. 2011). They have their own expectations and understandings of technology as well as life and learning styles (Camp & DeBlois 2007, p.22). They are familiar with Web 2.0 world which prompts them to compare learning experiences with digital games and social

networking sites (Tanner 2011, p. 31). Consequently, students have opportunities to produce information and contribute to the creation of knowledge by searching additional information related to course materials and sharing the information online at any time. Another impact is that learning process is not limited in the classroom with face to face communication. It can be done through many type of learning through ICT, such as computer assisted learning, online learning, distance learning, blended learning or e-learning.

Therefore, educational sector, higher education in particular, is required to adapt to the learning styles of this new generation of students (Hudson 2010). Educators need to redesign teaching strategies that meet this learners' need (Prensky 2001; Oblinger and Oblinger 2005; Bates and Sangra 2011). Re-identifying the nature and form of teaching and learning as well as considering the necessity of innovation in curriculum design and delivery is important for higher education sector (Hamilton, McFarland & Mirchandani 2000). Integrating ICT in higher education curriculum is a key resource to re-design teaching and learning practices that meet current and upcoming requirements (Alavi & Gallupe 2003; Leidner & Jarvenpaa 1995; Seethamraju 2007; Tamim et al. 2011; Zeeshan, Hashmi & Bhatti 2011).

### **POSITIVE IMPACTS OF ICT INTEGRATION INTO TEACHING AND LEARNING**

Scholars agree that ICT has positive impacts on educational applications. ICT is believed to revolutionize both teaching and learning in higher education (Bates & Sangra 2011; Laurillard 2006; Lowerison et al. 2006). Some scholars stated that ICT, such as computer, Internet and Web-based devices increase the quality of teaching and learning as well as increase sharing and construction of knowledge (Alavi, Wheeler & Valacich 1995; Leidner & Jarvenpaa 1995; Matzen & Edmunds 2007; Renes & Strange 2011). ICT integration into teaching and learning also enhances students' engagement in the learning process (Ashleigh 2005). Additionally, ICT use in teaching and learning provides means to create a learning environment in which learners can be creative, critical, constructive, and become producers of their own perspectives (Nagy & Bigum 2007, p. 81).

Research findings support the argument that ICT is important for teaching and learning practices as it has significant impact to enhance the quality of teaching as well as learning. For example, Campbell (2000) examined the effect of ICT use in

*Business Systems* class on students' interaction and ability to absorb knowledge from learning group. The researcher compared two groups of students from the Griffith University Australia. The first group is students who study at Logan campus which embracing flexible learning and the second group is students who study at the main campus at Nathan which delivered the subject by traditional means. Flexible learning is a teaching method that "generally endeavours to empower the student with greater autonomy and responsibility for his or her own learning" (Campbell 2000, p.352). In the flexible learning, ICT is an important element for learning practices. Campbell found that students from Nathan campus have a higher failure rate than students studying at Logan campus. In addition, students who study at Logan campus have a stronger feeling of friendships and higher motivation than students who study in Nathan campus. Similar result comes from Serva and Fuller (2004) who identified whether two constructs – active learning and effective media use – are important dimensions for positive student learning experience. The researchers conducted a survey involved 727 business students who were asked to assess the effectiveness of media use. The finding shows that the effectiveness of media use can greatly enhance students' learning experiences. Furthermore, Lowerison et al. (2006) found that the use of computer-mediated learning in postsecondary courses improves student engagement in class, and it also enhances instructors' access to learners' feedback. The finding supported Alavi and Gallupe's (2003) study which revealed that students are more engaged in learning activities because of less physical boundaries of the classroom and ease of access to the learning content and resources.

Literature also notes that ICT integration into higher education curricula prompts educators to provide learning environments in which they can develop students' soft skills required by business world (Bennis & O'Toole 2005; Chia & Holt 2008; Hay & Hodgkinson 2008; Mintzberg 2004; Pfeffer & Fong 2004; Schoemaker 2008). The deployment of ICT in teaching and learning enhances students' competence on team work and problem solving (Baldwin 1998). Furthermore, ICT significantly influences to the development of students' skills and competencies needed in business practices, such as communication, information handling, team work and problem solving (Alexopoulos & Lynn 2010; Baldwin 1998; Bates & Sangra 2011; Kooti 2011).

The positive impact of CT integration into teaching and learning practices is supported by two meta-analysis studies (Matthews 2012; Tamim et al. 2011). A second-order meta-analysis study (Tamim et al. 2011), a synthesis of 1,055 studies, proves the significant and positive influences of ICT integration into teaching and learning on student achievement. Another meta-analysis study conducted by The US Department of Education also confirms that students who learn through online environment have higher performance than those who learn through classical technique (Matthews 2012).

It can be concluded that ICT such as, computers, the Internet, and other web-based devices, are not only tools that serve and deliver the knowledge, but also become learning environments that prompt lecturers to design more active-learning methodologies (Yusuf 2012).

#### **INCONSISTENCY OUTCOME OF ICT USE IN BUSINESS EDUCATION**

Despite the significant role of ICT in enhancing teaching and learning quality, the findings from previous studies show inconsistent results (Hu & Hui 2012; Noguera & Watson 2004; Redmann & Kotrlik 2004; Serva & Fuller 2004). Instead of improving the teaching and learning processes, the integration of ICT led to some problems.

Noguera and Watson's (2004) study found that ICT integration in teaching and learning had no significant impact on student achievement and satisfaction. The finding is supported by other research (Redmann & Kotrlik 2004; Serva & Fuller 2004) which found that the use of ICT in business schools has low impact on learning effectiveness. Moreover, Hu and Hui (2012) emphasized that technology-mediated learning has no significant effect on learning effectiveness and satisfaction. Hu and Hui (2012) asserted that there is no evidence that ICT use in teaching will give better results for learning effectiveness than face-to-face method. In a recent study, Romeo, Lyoyd and Downes (2012) emphasized that ICT integration into learning practices has not given the significant impact to learning effectiveness as expected. Moreover, a study of Redmann and Kortlik (2004) found that lecturers still faced problem to integrate ICT in teaching and learning because they were not using the Internet for instructional purposes. The finding from Redmann and Kortlik's study is confirmed by Serva and Fuller (2004) who found that business educators infrequently used ICT properly to enhance the quality of teaching and learning.

The inconsistent research findings of ICT use in higher education indicate that an investment in ICT in undergraduate and graduate courses has not been equivalent in the actual use of ICT (Serva & Fuller 2004). Lecturers seem oblivious to the need of addressing successful implementation of using ICT to enhance the design and delivery of curricula. For this reason, Hawawini (2005) suggested that it is necessary to understand how educators in the higher education sector use ICT effectively in teaching and learning to enhance the design and delivery of the business curriculum.

### **POTENTIAL PROBLEMS**

Literature shows that ICT enhances the quality of teaching and learning. However, higher education institutions have to be aware that there are problems need to be addressed. Some studies demonstrate that academics staffs in the higher education institutions are experiencing anxieties in integrating ICT into their daily lives (McPherson & Nunes 2008; Redmann & Kotrlik 2004). Lecturers also still have problems working with computers because they are computer illiterate (Pannen, Riyanti & Pramuki 2007) or lack skills to embrace ICT development (Conole 2007; Pannen 2003). Serva and Fuller (2004) found that ICT are seldom used properly by higher education educators to enhance the quality of teaching and learning at the undergraduate level. Their usage of ICT is limited only for preparing materials and recording student data base.

### **FACTORS INFLUENCING THE ICT USE IN HIGHER EDUCATION**

Bingimlas (2009) and Ertmer (1999) argued that identifying the barriers of ICT use would help academic institutions to improve the use of ICT enhance the quality of teaching and learning. "Barrier" is defined as any situation that makes any progress or achievement is difficult to be obtained (WordNet 1997). Barriers of ICT use in teaching and learning in higher education can be classified into two groups of barriers. They are barriers related to people and barriers related to system/institution. Barriers related to people include any condition perceived or performed by educators, staff, and students. For examples, perceived of usefulness, perceive of ease of use of ICT; unwillingness to use ICT; lack of ICT skills; and insufficient time to plan and to use ICT (BECTA 2004; Bingimlas 2009; Davis 1989; Mumtaz 2000). System/institution barriers involve inadequate technical and administrative support; inappropriate teacher training; lack of access to

resources; and lack of incentives for integrating ICT in teaching. Other factors belong to institution/system barriers are organizational structure, organizational culture, and leadership.

#### **Factors Related to People**

Prior research revealed that educators' perception of ICT use has become a central factor that influences the effective use of ICT in teaching and learning (Cheng 2011; Igbaria, M. 1994; Igbaria, Magid, Guimaraes & Davis 1995; Igbaria, M. & Tan 1997; Van Raaij & Schepers 2008). A perception about e-learning system as an enjoyable method in teaching increases teachers' willingness to accept and use the ICT in the teaching (Cheng 2011). On the other hand, a negative perception on the ability of ICT tools obstructs the integration of ICT into teaching and learning (Brinkerhoff 2006). BECTA (2004) reported that "no benefit of technology use" perceived by teachers prevent them to integrate ICT in the teaching practices. Other factors related to people are an adequate level of competence to use ICT (Drent & Meelissen 2008) and willingness to use ICT (BECTA 2004; Birch & Sankey 2008; Mumtaz 2000; Weston 2005).

#### **Factors related to Institutional/System**

Literature also shows that several institution or system factors might hinder or support the use of ICT in teaching and learning (Ali 2004; Balanskat, Blamire & Kefala 2006; BECTA 2004). For examples, reward strategy and training in solving technical problems (Mumtaz 2000), an access to resources, the quality of ICT infrastructure, quality of hardware, and the availability of internet facilities (BECTA 2004; Bingimlas 2009). There are also factors that come from institution such as, organizational structure, organizational culture and leadership which have influence to the ICT use in teaching and learning in higher education level (Mumtaz 2000).

### **CONCLUSION AND RECOMMENDATION**

A rapid transformation in information and communication technology (ICT) is having a significant impact on every sphere of life, including higher education sector. However, research findings show inconclusive results. There are several potential factors which might hinder or support the ICT integration into teaching and learning.

At least two issues that need to be addressed for future agenda. First, scholar and academics practitioners need to build mutual relationship in examining factors that potentially hinder the use of ICT in teaching and learning. This agenda is necessary to improve the way educators use ICT in their teaching activities. Second, scholars need to



analysis the effective use of ICT in teaching and learning in higher education sector. Measuring the effectiveness of ICT is important to ensure the beneficial impact of ICT.

## References

- Alavi, M & Gallupe, RB 2003, 'Using information technology in learning: Case studies in business and management education programs', *Academy of Management Learning & Education*, vol. 2, no. 2, pp. 139-53.
- Alavi, M, Wheeler, BC & Valacich, JS 1995, 'Using IT to reengineer business education: An exploratory investigation of collaborative telelearning', *MIS Quarterly*, vol. 19, no. 3, pp. 293-312, viewed March 2012.
- Alexopoulos, A, Gorman, L, Lynn, T, Brewer, L, DiGangi, S & Jannasch-Pennell, A 2009, 'Technology ownership, usage and expectations of Business School freshmen: Evidence from an Irish university', *retrieved on August 2012*.
- Ali, M 2004, 'E-Learning in Indonesia education system', paper presented to The Seventh Programming Cycle of APEID Activities, Tokyo, Japan, 30 August - 6 September 2004.
- Asleigh, DA 2005, 'A study of successful implementation and management of educational technology in three New South Wales primary schools', PhD thesis, Australian Catholic University.
- Balanskat, A, Blamire, R & Kefala, S 2006, *The ICT impact report. A review of studies of ICT impact on schools in Europe* viewed January 2012.
- Bates, AW & Sangra, A 2011, *Managing technology in higher education. Strategies for transforming teaching and learning*, Jossey-Bass, San Francisco.
- BECTA 2004, *A review of the research literature on barriers to the uptake of ICT by teachers. A summary report*, viewed January 2012.
- Bennis, WG & O'Toole, J 2005, 'How business school lost their way', *Harvard Business Review*, vol. 83, no. 5, pp. 96-104.
- Bhatt, G, Emdad, A, Roberts, N & Grover, V 2010, 'Building and leveraging information in dynamic environments: The role of IT infrastructure flexibility as enabler of organizational responsiveness and competitive advantage', *Information & Management*, vol. 47, no. 7-8, pp. 341-9.
- Bingimlas, KA 2009, 'Barriers to the successful integration of ICT in teaching and learning environments: a review of the literature', *Eurasia Journal of Mathematics, Science & Technology Education*, vol. 5, no. 3, pp. 235-45, viewed April 2012.
- Birch, D & Sankey, M 2008, 'Drivers for and obstacles to the development of interactive multimodal technology-mediated distance higher education courses', *International Journal of Education and Development using ICT*, vol. 4, no. 1.
- Brinkerhoff, J 2006, 'Effects of a long-duration, professional development academy on technology skills, computer self-efficacy, and technology integration beliefs and practices', *Journal of Research on Technology in Education*, vol. 39, no. 1, p. 22.
- Camp, JS & DeBlois, PB 2007, 'Current issues survey report, 2007', *Educause Quarterly*, vol. 150, p. 25.6.
- Cheng, Y-M 2011, 'Antecedents and consequences of e-learning acceptance', *Information Systems Journal*, vol. 21, no. 3, pp. 269-99.
- Chia, R & Holt, R 2008, 'The Nature of Knowledge in Business Schools', *Academy of Management Learning & Education*, vol. 7, no. 4, pp. 471-86.
- Coyne, DM 2010, 'Utilizing Technology in University Admissions: A Change in Routine in Two Universities', Ph.D. thesis, University of California, Santa Barbara, via ProQuest Dissertations & Theses.
- Davis, FD 1989, 'Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology', *MIS Quarterly*, vol. 13, no. 3, pp. 319-40.
- Dhar, V & Sundararajan, A 2007, 'Issues and opinions—Information technologies in business: A blueprint for education and research', *Information Systems Research*, vol. 18, no. 2, pp. 125-41.
- Drent, M & Meelissen, M 2008, 'Which factors obstruct or stimulate teacher educators to use ICT innovatively?', *Computers & Education*, vol. 51, no. 1, pp. 187-99.
- Ertmer, P 1999, 'Addressing first- and second-order barriers to change: Strategies for technology integration', *Educational Technology Research and Development*, vol. 47, no. 4, pp. 47-61, viewed March 2012.

- Friga, PN, Bettis, RA & Sullivan, RS 2003, 'Changes in graduate management education and new business school strategies for the 21st century', *Academy of Management Learning & Education*, vol. 2, no. 3, pp. 233-49.
- Hamilton, D, McFarland, D & Mirchandani, D 2000, 'A decision model for integration across the business curriculum in the 21st century', *Journal of Management Education*, vol. 24, no. 1, pp. 102-26.
- Hawawini, G 2005, 'The future of business schools', *Journal of Management Development*, vol. 24, no. 9, pp. 770-82.
- Hay, A & Hodgkinson, M 2008, 'More success than meets the eye—A challenge to critiques of the MBA possibilities for critical management education?', *Management Learning*, vol. 39, no. 1, pp. 21-40.
- Hu, PJ-H & Hui, W 2012, 'Examining the role of learning engagement in technology-mediated learning and its effects on learning effectiveness and satisfaction', *Decision Support Systems*, vol. 53, no. 4, pp. 782-92.
- Hudson, K 2010, 'Working together: The role of collaborations in promoting the use of academic technologies in higher education', Ed.D. Thesis, University of Massachusetts Amherst, via ProQuest Dissertations & Theses.
- Igbaria, M 1994, 'An examination of the factors contributing to microcomputer technology acceptance', *Accounting, Management and Information Technologies*, vol. 4, no. 4, pp. 205-24.
- Igbaria, M, Guimaraes, T & Davis, GB 1995, 'Testing the determinants of microcomputer usage via a structural equation model', *Journal of Management Information Systems*, vol. 11, no. 4, pp. 87-114.
- Igbaria, M & Tan, M 1997, 'The consequences of information technology acceptance on subsequent individual performance', *Information & Management*, vol. 32, no. 3, pp. 113-21.
- Jimba, SW 1999, 'Information technology and underdevelopment in the Third World', *Library review*, vol. 48, no. 2, pp. 79-83.
- Kooti, JG 2011, 'The Efficient use of technology in the business curriculum: A survey of AACSB member deans', *Journal of College Teaching & Learning (TLC)*, vol. 1, no. 1, viewed March 2013.
- Lane, LM 2008, 'Toolbox or trap? Course management systems and pedagogy', *Educause Quarterly*, vol. 31, no. 2, p. 4.
- Laurillard, D 2006, 'E-learning in higher education', *Changing higher education: The development of learning and teaching*, pp. 71-84.
- Leidner, DE & Jarvenpaa, SL 1995, 'The use of Information Technology to enhance management school education: A theoretical view', *MIS Quarterly*, vol. 19, no. 3, pp. 265-91.
- Lowerison, G, Sclater, J, Schmid, RF & Abrami, PC 2006, 'Student perceived effectiveness of computer technology use in post-secondary classrooms', *Computers & Education*, vol. 47, no. 4, pp. 465-89.
- Matthews, RJ 2012, 'A Portrait of the Early 21st Century MBA', *Ph.D. thesis*, Nova Southeastern University, via ProQuest Dissertations & Theses (PQDT)
- Matzen, NJ & Edmunds, JA 2007, 'Technology as a catalyst for change: The role of professional development', *Journal of Research on Technology in Education*, vol. 39, no. 4, p. 417.
- Mills, GE, Jr. 2008, 'An exploration of factors that influence the use of information technology for institutional effectiveness in terms of the research and learning productivity of a college or university', *Ph.D. Thesis*, The Florida State University, via ProQuest Dissertations & Theses (PQDT).
- Mintzberg, H 2004, *Managers, Not MBAs: A Hard Look at the Soft Practice of Managing and Management Development*, Berrett-Koehler Series, Berrett-Koehler Publishers, San Fransisco.
- Mumtaz, S 2000, 'Factors affecting teachers' use of information and communications technology: a review of the literature', *Journal of Information Technology for Teacher Education*, vol. 9, no. 3, pp. 319-42.
- Nagy, J & Bigum, C 2007, 'Bounded and unbounded knowledge: Teaching and learning in a Web 2 World', *Online Submission*, p. 11.
- Noguera, JH & Watson, EF 2004, 'Effectiveness of using an enterprise system to teach process-centered concepts in business education', *Journal of Enterprise Information Management*, vol. 17, no. 1, pp. 56-74.
- Oblinger, D & Oblinger, JL 2005, *Educating the net generation*, vol. 264, Educause, Washington, DC.
- Pfeffer, J & Fong, CT 2004, 'The business school 'Business': Some lessons from the US experience\*', *Journal of Management Studies*, vol. 41, no. 8, pp. 1501-20.

- Powell, TC & Dent-Micallef, A 1997, 'Information Technology as competitive advantage: The role of human, business, and technology resources', *Strategic management journal*, vol. 18, no. 5, pp. 375-405.
- Prensky, M 2001, 'Digital natives, digital immigrants Part 1', *On the horizon*, vol. 9, no. 5, pp. 1-6.
- Redmann, DH & Kotrlik, JW 2004, 'Technology integration into the teaching-learning process by Business Education teachers', *Delta Pi Epsilon Journal*, vol. 46, no. 2, pp. 76-91.
- Reyes, S & Strange, A 2011, 'Using Technology to enhance higher education', *Innovative Higher Education*, vol. 36, no. 3, pp. 203-13.
- Romeo, G, Lloyd, M & Downes, T 2012, 'Teaching Teachers for the Future (TTF): Building the ICT in education capacity of the next generation of teachers in Australia', *Australasian Journal of Educational Technology*, vol. 28, no. 6, pp. 949-64.
- Ryssel, R, Ritter, T & Gemünden, HG 2004, 'The impact of information technology deployment on trust, commitment and value creation in business relationships', *Journal of Business & Industrial Marketing*, vol. 19, no. 3, pp. 197-207.
- Sánchez, J, Salinas, A, Contreras, D & Meyer, E 2011, 'Does the new digital generation of learners exist? A qualitative study', *British Journal of Educational Technology*, vol. 42, no. 4, pp. 543-56.
- Sandery, PL 1999, 'Information Technology and University Teaching Productivity', Doctor of Philosophy thesis, University of South Australia.
- Schoemaker, PJH 2008, 'The future challenges of business: Rethinking management education and research', *California Management Review*, vol. 50, no. 3, pp. 119-40.
- Seels, B & Richey, R 1994, *Instructional technology: The definition and domains of the field*, Association for Educational Communications and Technology Bloomington, Ind.
- Seethamraju, R 2007, 'Enterprise Systems (ES) software in business school curriculum -- Evaluation of design and delivery', *Journal of Information Systems Education*, vol. 18, no. 1, pp. 69-83.
- Serva, MA & Fuller, MA 2004, 'Aligning what we do and what we measure in business schools: Incorporating active learning and effective media use in the assessment of instruction', *Journal of Management Education*, vol. 28, no. 1, pp. 19-38, viewed August 2012.
- Shaw, G 2010, *Information communication technology at university: skills for success*, Charles Darwin University Press, Darwin, N.T.
- Tamim, RM, Bernard, RM, Borokhovski, E, Abrami, PC & Schmid, RF 2011, 'What forty Years of research says about the impact of technology on learning. A second-order meta-analysis and validation study', *Review of Educational Research*, vol. 81, no. 1, pp. 4-28.
- Tanner, L 2011, 'Universities must adapt or die in the e-learning world.', *The Australian* 26 October 2011, p. 31.
- Thomas, CD 2011, 'Factors affecting faculty use of technology-enhanced instruction at research universities', *Ph.D.Thesis*, The University of Texas at Austin, via ProQuest Dissertations & Theses.
- UNESCO 2003, *Building capacity of teachers/facilitators in technology-pedagogy integration for improved teaching and learning: Final Report*, UNESCO Bangkok, Bangkok.
- Van Raaij, EM & Schepers, JJJ 2008, 'The acceptance and use of a virtual learning environment in China', *Computers & Education*, vol. 50, no. 3, pp. 838-52, viewed September 2012.
- Weston, TJ 2005, 'Why faculty did—and did not—integrate instructional software in their undergraduate classrooms', *Innovative Higher Education*, vol. 30, no. 2, pp. 99-115.
- Young, SB 2012, 'Use of technology in administrative communication in a university', *Ph.D. Thesis*, Walden University, via ProQuest Dissertations & Theses.
- Yuhetty, H 2002, 'ICT and education in Indonesia', viewed 27 December 2011.
- Yusuf, K 2012, 'Impact of information and communication technology on teaching of business education courses in colleges of education in Nigeria', *Master thesis*, University Zaria Nigeria.
- Zeeshan, A, Hashmi, MA & Bhatti, N 2011, 'Impact of Technology on Business Schools: Perceptions of Faculty & Management', *Journal of Research & Reflections in Education (JRRE)*, vol. 5, no. 2, pp. 128-45, viewed July 2012.

## TEACHING AND LEARNING ENGLISH THROUGH UNIFORM RESOURCE LOCATOR (URL) STRATEGY

**Khamim Mustofa**  
SMP Muh 2 Kebumen

### **Abstract**

*In Indonesia, English is a compulsory subject which is taught in Junior High School and Senior High School as a foreign language. As a result, the Indonesian government always makes effort to improve the quality of teachers through seminary, training and other component which are involved in education process. The education in Indonesia has been improved from time to time; one of them is established by curriculum. According to the competence based curriculum of Junior High School, the goal of foreign language learning to learn how to communicate by using the target language in oral or written. So after learning English, students should be able to communicate in English spoken or written.*

*In my opinion, the functions of learning English in Junior High School are; first, by studying English students are expected to have a means to develop their knowledge of science, technology and culture. The second is, students are expected to be able to support the development of tourism. The third is, the students are able to learn and continue their study in a favorite school. The forth is they are able to know the world through the internet which communicated in English.*

*Based on the paradigm above, we must have a good strategy to success our teaching and gain our students' purpose, perhaps using minimum energy and time but getting maximum result. The writer is not only offers direct and indirect strategy to improve their learning but also internet media.*

*Internet is one of the most important to improve our English skill, there are some English programs provided completely, as a professional teacher we have to operate those programs or URL spread to gain more varieties learning. On this paper, the writer chooses some URLs that considered the easiest operation for all levels as one of strategy ways to improve our teaching and learning.*

**Keywords:** Strategy, direct, indirect, Internet

### **1. Introduction**

Students need to be autonomous in their learning. Thus the essential element in the teaching

process is to encourage learners to learn their second language in appropriate and successful ways. Educators are to pay attention to whether the learners learn the language better than before and whether they make progress in the process to improve their proficiency. Consequently, learners are to be made independent in their foreign language learning. Hence, foreign language learners are to be shown the how to learn a second language independently, namely language learning strategies.

Goethe In (1997) said that good teaching should enable learners to learn better, because in the end it is not the teaching but the learning that matters, implying that the ultimate goal in teaching is **to make learners learn independently**. It is a character of “good language learners”.

As professional teachers, we must be able to create a student to learn, create intelligent students to adapt the changes of curriculum and adjust the development of educational purposes to deal with curriculum 2013. Students should be active and motivated to solve the problems faced in the classroom and present it in front of the class with the teacher guidance.

I was very concerned when I observed in some schools, particularly in my town, that the English language teachers still use a conventional method by using the textbook without any interesting media. It is one of our home works to all of us to turn it into an interesting learning process for obtaining the desired learning objectives.

I think, declining of national test scores in the English subject is caused by the lack of creativity of the teacher in the learning process, so that students' absorption is not satisfactory with our expectations, because most students in Junior High School still have difficulties in receiving the material given, so that they can not convey their ideas clearly because of their limited experience to solve the problems especially to analyze the texts.

Oxford (1991) classifies LLS into direct and indirect strategies. The category of direct strategies consists of memory strategies, cognitive strategies and compensation strategies while indirect strategies comprise metacognitive strategies, affective strategies and social strategies. The complete version is as follows:

## 2. Direct Strategies

### a. Memory Strategy

- 1) Creating mental linkages: grouping, associating/elaborating, placing words into context
- 2) Applying images and sounds: using imagery, semantic mapping using keywords, representing sounds in memory.
- 3) Reviewing well: structured reviewing
- 4) Employing action: using physical response or sensation, using mechanical technique.

### b. Cognitive Strategies

- 1) Practicing: repeating, formally practicing with sounds and writing systems  
Recognizing and using formulas and patterns, recombining, practicing naturalistically.
- 2) Receiving and sending messages: getting the idea quickly, using resources for receiving and sending messages.
- 3) Analyzing and reasoning: reasoning deductively, analyzing expressions, analyzing contrastively (across language), translating, transferring.
- 4) Creating structure for input and output: taking notes, summarizing, highlighting.

### c. Compensation strategies

- 1) Guessing intelligently: using linguistic clues, using other clues
- 2) Overcoming limitations in speaking and writing: switching to the mother tongue, getting help, using mime or gesture, avoiding communication partially or totally, selecting the topic, adjusting or approximating the message, coining words, using a circumlocution or synonym.

## 3. Indirect Strategies

### a. Metacognitive Strategies

- 1) Centering your learning: over viewing and linking with already known material, paying attention, delaying speech production,
- 2) Arranging and planning your learning: finding out about language learning, organizing, setting goals and objectives, identifying the purpose of a language task., planning for language task, seeking practice opportunities
- 3) Evaluating your learning: self-monitoring and self- evaluation

### b. Affective Strategies

- 1) Lowering your anxiety: using progressive relaxation, deep breathing or meditation, using music, using laughter.
- 2) Encouraging yourself: making positive statements, taking risks wisely, rewarding yourself.
- 3) Taking your emotional temperature: listening to your body, using checklist, writing a language learning diary, discussing your feeling with someone else.

### c. Social Strategies

- 1) Asking questions: asking for clarification or verification and asking for correction.
- 2) Cooperating with others: cooperating with peers, cooperating with proficient users of the new language.
- 3) Empathizing with others: developing cultural understanding, becoming aware of others' thoughts and feeling the strategies need to be trained to students. The success of strategy training was discovered by Chamot ( 2006) among students for high-proficiency in English. The effect of the strategy was that more strategies were used by the students. It implies that in developing instructional material, strategy training is advisable to be involved.

There are also some strategies that offered by New Teacher Center @ UC Santa Cruz (2005) :

- a. The first of the six key strategies is *vocabulary and language development*, through which teachers introduce new concepts by discussing vocabulary words key to that concept. Exploring specific academic terms like *algorithm* starts a sequence of lessons on larger math concepts and builds the student's background knowledge.
- b. The second strategy is *guided interaction*. With this method, teachers structure lessons so students work together to understand what they read—by listening, speaking, reading, and writing collaboratively about the academic concepts in the text.
- c. The third strategy is *metacognition and authentic assessment*. Rather than having students simply memorize information, teachers model and explicitly teach thinking skills (*metacognition*) crucial to learning new concepts. Research shows that metacognition is a critical skill for learning a second language and a skill used by highly proficient readers of any language. With *authentic assessments*,

teachers use a variety of activities to check students' understanding, acknowledging that students learning a second language need a variety of ways to demonstrate their understanding of concepts that are not wholly reliant on advanced language skills.

- d. The fourth strategy is *explicit instruction*, or direct teaching of concepts, academic language, and reading comprehension strategies needed to complete classroom tasks.
- e. The fifth strategy is the use of *meaning-based context and universal themes*, referring to taking something meaningful from the students' everyday lives and using it as a springboard to interest them in academic concepts. Research shows that when students are interested in something and can connect it to their lives or cultural backgrounds they are more highly motivated and learn at a better rate.
- f. The final strategy is the use of *modeling, graphic organizers, and visuals*. The use of a variety of visual aids, including pictures, diagrams, and charts, helps all students—and especially ELL students—easily recognize essential information and its relationship to supporting ideas. Visuals make both the language and the content more accessible to students

#### 4. Internet Media (URL)

I think learning through URL is one of many ways that we can apply in our teaching-learning. That is good and helpful. URL is so inspiring for us that we can teach something new to my students.

Free English Course from the URL will motivate and encourage the learners to learn English by themselves and in the hope they can improve their knowledge and competence. That's why this is inspiring me to share this kind of English course with my students or at least with my children.

There are many ways for the learners in enriching English vocabulary. However, the use of URL as one of IT-based learning techniques may become a better way in solving the problem of teaching and learning. It may encourage and attract the learners to learn more the English by doing self-access activities.

I feel that teachers and students are now really well-equipped as technology grows very rapidly. There are a lot of facilities to help them improve their learning. The use of URL like me is one simple example of how everybody can take the benefit of technology in terms of language learning. Not only it is easier to do, IT-based learning, in my

opinion, may encourage students to know more and give them opportunity to learn in fun and more enjoy atmosphere of learning. When they can enjoy their learning, I believe they will perform their best. The problem is that many teachers themselves are still illiterate in terms of technology. Consequently, learning may not run smoothly. This situation is surely the opposite side of what to expect. URL has inspired me as a teacher to make of use technology to accelerate my students' learning. I also hope that URL will be a breakthrough to help me solve learning obstacles which my students often find in their learning.

URL stands for Uniform Resource Locator. A URL is a formatted text string used by Web browsers, email clients and other software to identify a *network resource* on the Internet. Network resources are files that can be plain Web pages, other text documents, graphics, or programs. <http://compnetworking.about.com>

According to the writer, internet also is one of the important media that used as the best strategy in Language Learning Strategy because it is easy operated and can be applied in many levels, such as:

No	Resources URL	The description of URL
1	<a href="http://www.youtube.com/user/MinooAngloLink?feature=watch">www.youtube.com/user/MinooAngloLink?feature=watch</a>	We also can learn by watching video, can't we? I think YouTube is complete enough to look for learning resources
2	<a href="http://www.engvid.com/">www.engvid.com/</a>	This URL contain of learning English through on line video
3	<a href="http://www.ehow.com/way_5415209_english-grammar-beginners.html">www.ehow.com/way_5415209_english-grammar-beginners.html</a>	tips for learning English
4	<a href="http://www.esl-library.com/lessons.php">www.esl-library.com/lessons.php</a>	many themes in daily life
5	<a href="http://www.eslkidslab.com/lessons/index.html">www.eslkidslab.com/lessons/index.html</a>	good material of vocabulary and language function for kids

#### RENCANA PELAKSANAAN PEMBELAJARAN(RPP)

Sekolah : SMP Muhammadiyah 2Kebumen  
Mata Pelajaran: Bahasa Inggris  
Kelas/Smt : IX/Gasal  
Alokasi Waktu : 40 menit  
SK : Listening, Speaking, Reading and Writing

No	Urutan Materi	Materi
1	First one	<i>Listening the text : "Timun mas" Find the sentence that used "Past tense"</i>
2	The second one	<i>The understanding of Narrative text</i>
3	The third one	<i>Narrative text structure</i>
4	The forth one	<i>The use of simple past tense</i>
5	The fifth one	<i>Writing the summary of Narrative text by title "timun mas"</i>
6	The sixth one	<i>Grammar test</i>

## CONCLUSION

Oxford (1991) classifies LLS into direct and indirect strategies. The category of direct strategies consists of memory strategies, cognitive strategies and compensation strategies while indirect strategies comprise metacognitive strategies, affective strategies and social strategies.

### Direct Strategies

1. Memory Strategy
2. Cognitive Strategies
3. Compensation strategies

### Indirect Strategies

1. Metacognitive Strategies
2. Affective Strategies
3. Social Strategies

There are also some strategies that offered by New Teacher Center @ UC Santa Cruz (2005) :

1. The first of the six key strategies is *vocabulary and language development*,
2. The second strategy is *guided interaction*.
3. The third strategy is *metacognition and authentic assessment*.

4. The fourth strategy is *explicit instruction*, or direct teaching of concepts, academic language, and reading comprehension strategies needed to complete classroom tasks.
5. The fifth strategy is the use of *meaning-based context and universal themes*
6. The final strategy is the use of *modeling, graphic organizers, and visuals*.

As a professional teacher we have to operate some URLs programs that spread free on internet to gain more varieties learning. Those URLs can improve our English skill and our teaching and learning.

## References

- <http://www.scholastic.com/teachers/article/strategies-teaching-english-language-learners>
- <http://www.supportrealteachers.org/strategies-for-english-language-learners.html>
- <http://compnetworking.about.com>
- J.J Wilson strategies from Postcards
- Popular and useful learning strategies in language acquisition amongst teenagers, Erla Edvardsdóttir, 050378-5199, University of Iceland, School of Education, Faculty of Teacher Education April 2010.
- J. Michael O'Malley and Anna Uhl Chamot, Learning Strategies In Second Language Acquisition.
- 2012 International Conference on Language, Media and Culture IPEDR vol.33 (2012) © (2012) IACSIT Press, Singapore.
- Jermaine S. McDougald, The use of modern technology in the EFL classroom, an evaluation of technology as a tool in language teaching. 2005.
- Use of Technology in English Language Teaching and Learning'; An Analysis, Solanki D Shyamlee, 2012.

## ANALOGICAL THINKING IN MATHEMATICS PROBLEM SOLVING

Irwani

Muhammadiyah University of Gresik

email : irwanizawawi@ymail.com

### Abstract

*Analogy has been widely used in real life. Analogies are often used in problem solving. Therefore, every student must learn how to use the analogy in problem solving. Especially when they are in school, the analogy is often used to solve problems that are similar to each other. This study is intended to obtain a description of the stages of analogical thinking students in solving mathematical problems.*

*This study uses qualitative approach with descriptive-exploratory research. The subjects were junior high school students. Auxiliary instrument is a matter of mathematical analogy, which is composed of the target resource issues and problems. Researchers conducted in-depth interviews to the subject, which is done in conjunction with the subject solve mathematical analogy. Activity of subjects during the activity recorded with a camcorder and voice recorder. The recording was transcribed and coded, then analyzed for inferences.*

*As a result, subject to resolve the problem follows the structure of the target source problem solving, with the stages: 1) Encoding, the subject encodes the information contained in the source and target problems. Such information is information that is known, being asked, or other information that is useful to both settle the matter. 2) Inferring, subject concluded to use the concepts, formulas or definitions in order to resolve the source of the problem. 3) Mapping, a subject using the role or a way of resolving the problem source to be used in solving the target problem. 4) Applying, subjects completed the target problem.*

**Keywords:** *Analogical Thinking, Mathematical Problem Solving*

### BACKGROUND

One of the goals of mathematics education, among others is aimed at using the reasoning on the pattern and nature of mathematics. Reasoning indicators to be achieved by learners include the ability to draw conclusions from statements and find patterns or mathematical nature of the symptoms to make generalizations (Depdiknas,

2006). One form of reasoning is analogical reasoning. Analogy is the similarity between the two situations, one that has been known (source) and another less well understood (target) (Reid, 2002). Reasoning is a particular form of thinking with regard to the deduction based on the premises (Copi, 1982). Others say reasoning is thinking activities that have certain characteristics in determining the truth (Suriasumantri, 2001). Think the analogy is a way of thinking in drawing conclusions inductively by observing the pattern of the relationship or the relationship between the structure of the problem is already known (the source) to the problem to be solved (the target).

Thinking or cognitive process is strongly associated with information processing. Thinking is a mental activity which includes receiving information, processing or information processing, information storage, and recall of information (Marpaung, 1986). There are three stages in the processing of information in memory, namely: 1) *Encoding*, which aims to transform the information received so that individuals can put in the memory. 2) *Storage*, which serves to retain the information. 3) *Retrieval*, which is the process of accessing the information that has been stored, (Sternberg, 2003).

Information processing in inductive reasoning known as "Componential theory of information processing in inductive reasoning" (Sternberg, 1987). Components of information processing in inductive reasoning consists of seven components, namely: 1) Encoding. 2) Inference. 3) Mapping. 4) Applications. 5) Comparison. 6) Justification. 7) Response. Componential theory comes with certain models that apply to a particular inductive problems. Components of information processing theory to determine where to draw the model, the model also determines the way in which the performance of the set (or subset) of the components are combined into a strategy to resolve the problem. Resolve the problem with the analogy of the form  $A : B :: C : (D1, D2)$  using the 7 components of information processing (Sternberg, 2008) while completing a problem with the analogy of the form  $A : B :: C : (D)$  using the four components of information processing, ie 1)



Encoding, 2) Inferring, 3) Mapping, and 4) Applying (Sternberg, 1987).

Analogical thinking in solving mathematical problems is the way of thinking of students in solving a target problem by using a source of the problem (English, 1999). In this study the process of thinking in solving mathematical analogy is a combination of measures developed by Sternberg (1987) and Novick (1999), which in turn according to the authors called “analogical thinking process of students in solving mathematical problems”, includes four things: 1) Encoding is the process by which students perform encoding the information contained in the resource and target problems. 2) Inferring is the process of inference to use the concepts, formulas, definition or boundaries in order to solve the problem source. 3) Mapping is the process of mapping role, the pattern or structure of the source problem solving to solving the target problem. 4) Applying is the process of applying role, the pattern or structure of solutions sources in solving target problem. (see figure 1)

Relationship between analogical thinking in solving problems with analogical thinking in solving mathematical problems can be seen in Figure 1.

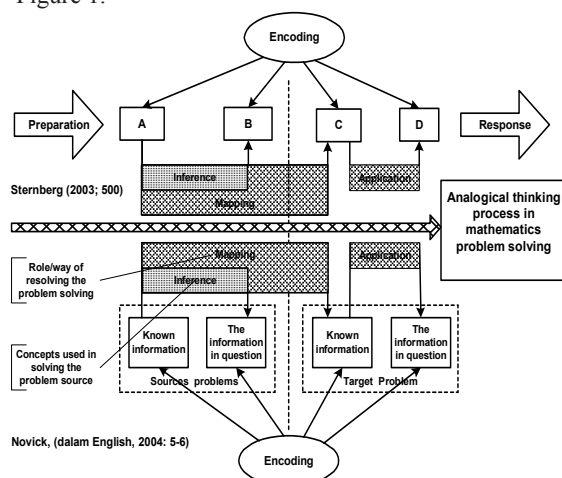


Figure 1. Relationship between analogical thinking in solving problems with analogical thinking in solving math problems

Analogical thinking is to think about the structure or patterns of relationship (predicate) between the source of a problem with the target problem, it is necessary to think the analogy stages in solving mathematical problems. Based on the above background, the question in this research is: “How is analogical thinking stage of junior high school students in solving mathematical problems?”

While the purpose of this study was to obtain descriptions of the process of analogical thinking junior high school students in solving mathematical problems.

## METHOD

This study employed a qualitative approach. It is called a qualitative approach, since the description of the results of this study is elaborated using words or said research in the field of language and description (Faisal, 1990). If it is viewed from the goal, and the presence or absence of something variable manipulation, this study is a descriptive study. Specifically the purpose of this study to explore the thought processes analogy students in solving mathematical problems, this study considered exploratory study. Thus, this study used a qualitative approach with descriptive-exploratory research design.

The subjects were junior high school students. In consideration of the students at the level they are at the stage of inductive thinking, because the analogy included in phase inductive thinking. Accordance with the opinion (Soedjadi, 2000) said that deductive logic is very important in mathematics because mathematics is one of the characteristics. However, in elementary and junior high level, still required the use of inductive logic. Subjects selected based on tests of mathematical ability groups of high math ability students category (score  $\geq 75$ ). The results of math ability test the eighth grade students of SMP Negeri 1 Gresik, the highest score achieved by NAS with a value of 100, then the subject of this study is NAS.

The main instrument is the researcher himself, in addition to his position as a researcher as well as an observer, as well as a planner, analysis, interpretation of data, and eventually became the reporting of research results. Supporting instruments are 1) *Mathematics Problem Ability Test*. Mathematical skills test is used to encompass the study subjects. About math ability test consists of 12 questions are based on the national exam questions last 5 years. Material about mathematics ability tests selected only until the eighth grade junior high school mathematics. The selection of material is based on the curriculum KTSP in 2006. 2) *Mathematical Analogies problem*. This question is used to explore students' analogical thinking in solving mathematics problems. Matter of mathematic analogy consists of the resource and target problems. (see appendix)

Subjects were given about the mathematical analogy, based on answers to a subject, then conducted interviews to explore further stages of

thinking students in solving mathematical problems. Data results of the written test and interview is then reduced to sharpen, classify and dispose of unnecessary, and organize raw data obtained from the field. Based on the results of the reduction, the data is presented and described in the form of a more systematic conclusion to be done.

## RESULTS AND DISCUSSION

### RESULTS

Subjects in solving mathematical problems, first of all work on the problem directly with the source of its own way based on previous experiences. Second, subjects in solving the target problems tend to follow a pattern or structure of the source problem solving.

Results jobs research at the source problem (M1) and the target problem (M2) is:

#### 1) Completion of the problem source (M1)

$$\begin{array}{r} 16 \quad 14 \quad 8 \\ 2 \times 8 \quad 7 \quad 4 \\ \hline 16 \quad 14 \quad 8 \end{array}$$

$$\text{KPE} = 2 \times 4 \times 2 \times 7 = 112$$

Karena masih bersisa 6 kue, maka:  $112 + 6 = 118$

$$\begin{array}{r} 118 \\ 2 \\ \hline 59 \end{array}$$

118 = 59

118 = 59 (tidak habis)

Selanjutnya, harus ditanyakan, menjadi:

$$118 \times 2 = 236$$

Karena bersisa 6 kue, maka:  $236 + 6 = 242$

$$\begin{array}{r} 242 \\ 2 \\ \hline 121 \end{array}$$

242 = 121

121 = 121 (tidak habis)

Karena masih 11 kue habis, maka ditanyakan lagi, menjadi:

$$121 \times 2 = 242$$

Karena bersisa 6 kue, maka:  $242 + 6 = 248$

$$\begin{array}{r} 248 \\ 2 \\ \hline 124 \end{array}$$

248 = 124

124 = 124 (tidak habis)

Jadi, banyak kue minimal yang dibuat adalah 342 kue.

#### 2) Completion of the problem target (M2)

$$\begin{array}{r} 12 \quad 9 \quad 6 \\ 2 \times 6 \quad 3 \quad 2 \\ \hline 12 \quad 9 \quad 6 \end{array}$$

$$\text{KPE} = 2 \times 3 \times 2 \times 2 = 24$$

Karena masih bersisa 2, maka:  $24 + 2 = 26$

$$\begin{array}{r} 26 \\ 2 \\ \hline 13 \end{array}$$

26 = 13 (tidak habis)

Karena tidak habis, maka KPE harus ditanyakan,

$$24 \times 2 = 48$$

Selanjutnya:  $48 + 2 = 50$

$$\begin{array}{r} 50 \\ 2 \\ \hline 25 \end{array}$$

50 = 25 (tidak habis)

Karena tidak habis, maka harus ditanyakan KPE harus ditanyakan,

$$48 \times 2 = 96$$

Selanjutnya:  $96 + 2 = 98$

$$\begin{array}{r} 98 \\ 2 \\ \hline 49 \end{array}$$

98 = 49 (tidak habis)

Jadi, banyak kue minimal yang dibuat adalah 98 kue.

From the results of the written test can be described as the following things:

1. *Encoding* phase, subjects identified the known information and information in question on the issue in either the source or the target of the problem.
2. *Inferring* phase, subjects using the concept of the LCM, multiplication, and division by zero residual to solve the source problem (M1).
3. *Mapping* phase, subjects using the concept of the LCM, multiplication, division with remainder zero on the source problem (M1) to solve the target problem (M2).
4. *Applying* phase, subjects completed the target problem.

Then the subject of a written response followed by an interview to dig deep subject knowledge to solve problems based on the source and the target problem stages an analogical thinking in solving mathematical problems.

#### 1. Encoding phase

Excerpts of the interview as follows:

P:	What is known of the problem 1?
S:	Each bag filled with 16 cookies, the remaining 6 cake; filled with 14 cookies, the remaining 6 cake; 8 pastry filled, the remaining 6 cake; 9 stuffed pastry, no residual
P:	Are there more is known of the problem 1?
S:	If each bag filled with 16, 14 and 8 cakes, together remaining 6 cake. Cake brought nothing left
P:	If the problem 2, what is known?
S:	Decorative stones put in 12 boxes,

	remaining 2 stones; put in 8 cardboard, remaining 2 stones; put in 6 cardboard, remaining 2 stones; put in 7 cardboard, no trace
P:	Much less is known of the problem 2?
S:	Because it included 12, 8 and 6 cardboard, together remaining 2 ornamental stone. Later that brought a lot of the same cake
P:	Asked what the problem 1?
S:	Minimal brought a lot of cake
P:	What is being asked to issue 2?
S:	Ornamental stones that were taken between 50-200

## 2. *Inferring* phase

P:	Well, if the problem 1, how to solve it completely?
S:	Sought before the “ <i>lowest common multiple</i> ” (LCM) of 16, 14 and 8, was 112. Total number of cakes that are multiples of 112 was taken, namely: 112, 224, 336, 448, 560, ... Because the remaining 6, then multiples of 112 plus 6, ie 118, 230, 342, 454 ... So the smallest number divisible by 9 is 342

## 3. *Mapping* phase

P:	If the problem 2, how its solution?
S:	The same, which is for first LCM of 12, 8 and 6. Then multiples of plus 2. Then look for numbers between 50 and 200 is divisible by 7

## 4. *Applying* phase

P:	Detail how?
S:	LCM of 12, 8 and 6, which is 24. Total number of ornamental stones that were taken are multiples of 24, ie: 24, 48, 72, 96, 120, 144, 168, 192, ... Because the remaining 2, then multiples of 24 plus 2, ie 26, 50, 74, 98, 122, 146, 170, 194, ... Then the numbers between 50 and 200 are divisible by 7 is 98

Note: P = Researcher, S = Subject

From the results of the interview can be described as follows:

1. *Encoding* phase, subjects identified the known information and asked both the problem at the source and the target problem. Known information on the source of the problem: if each bag is filled with 16 cookies, the remaining 6 cake; each bag filled with 14 cookies, the remaining 6 cake; every bag filled with 8 cakes, remaining 6 cookies, and if each bag is filled 9 cake, no cake remaining. Many brought cake should not be left. The elements in question on

the source of the problem: a minimum total amount brought cake. The elements that are known to the target problem: if the ornamental stone put in 12 boxes, remaining 2 decorative stone; ornamental stones put in 8 cardboard, remaining 2 decorative stone; ornamental stones put in 6 cardboard, remaining 2 decorative stone; stone decorative cardboard put in 7, no stone is left ornamental. Many ornamental stones that were taken should not be left. The elements in question on the issue of targets: ornamental stone taken between 50 and 200.

2. *Inferring* stage, subject resolved the source problem using the LCM concept, which is looking for LCM of 16, 14 and 8, was 112. LCM 112 plus 6 cakes left, then divide the 9. If the LCM after plus 6 is not divisible by 9, then the LCM folded. Then calculate the smallest number divisible by 9, which is 342.
3. *Mapping* phase, subjects employed the LCM concept to find LCM of three numbers. LCM is added to the remaining number, then divided by the number, which when divided no trace. If the LCM after plus the remaining number is not divisible, then the number is folded. Ultimately determine the number divisible.
4. *Applying* phase, subjects completed the target problem. LCM of 12, 8 and 6, which is 24. LCM 24 plus 2 remaining ornamental stones, namely 26. Then divided by 7. Because 26 is not divisible by 7, then folded and the LCM each plus 2. Then look for numbers between 50 and 200 is divisible by 7. Then the number between 50 and 200 are divisible by 7 is 98.

## CUNCLUSION

Standard procedure in solving math problems is to identify known information, the information in question as well as other information that can help in solving mathematical problems. If these activities are done on a matter of two or more similar, this activity is called *encoding* the resource and target problems. Based on the known elements and asked the subjects to use the concept LCM concluded 3 numbers, multiples and the concept of numbers divisible resources problem to resolve the problem. This is done on the subject of *inferring* stage. Rolein the form of draft LCM 3 numbers, multiples and the concept of numbers divisible by that of the source of the problem is *mapped* to be used in solving the target problem. Finally resolve the target subject.

Subject solved the target problem tends to follow a pattern or structure of the source problem solving. Stages of the target is subject solved the

problem: 1. *Encoding* phase, the subject encodes the information contained in the resource and target problems. Information include information that is known, the information in question, or any other information related to both settle the matter; 2. Stage concludes (*Inferring*), subject concluded to use the concepts, formulas or definitions in order to resolve the source problem. 3. *Mapping* phase, subjects using the role or a way of resolving the source problem to be used in solving the target problem. 4. *Applying* phase, subjects completed the target problem.

## References

- Copi, Irving M. (1982). *Introduction to Logic*, Mcmillan Publishing Co, Inc, New York.
- Depdiknas. (2006). *Mata Pelajaran Matematika Sekolah Atas (SMA) dan Madrasah Aliyah (MA)*, Pusat Kurikulum Balitbang, Jakarta
- Faisal, Sanafiah. (1990). *Penelitian Kualitatif*, YA2, Malang.
- Marpaung. (1986). *Sumbangan Pikiran terhadap Pendidikan Matematika dan Fisika*, Pusat Penelitian Pendidikan Matematika/Informatika FPMIPA, IKIP Sanata Darma, Yogyakarta
- Reid, David A. (2002). Conjectures and Refutations in Grade 5 Mathematics, *Journal for Research in Mathematics Education* 2002, 33, (1); 5-29. Published by: National Council of Teachers of Mathematics.
- Suriasumantri, Jujun. S. (2001). *Ilmu dalam Perspektif*, Yayasan Obor Indonesia, Jakarta.
- Sternberg, R.J. (2003). *Cognitif Psychology*. 3<sup>TH</sup> Edition. Yale University.
- Sternberg, R.J. (1987). *Benyon IQ a Triarchic Theory of Human Intelligence*. Cambridge University Press, New York.
- Sternberg, R.J. (2008). *Psikologi Kognitif*. Ed. 4. (Terj.: Yudi Santoso), Pustaka Pelajar, Yogyakarta.
- English, Lyn D. (1999). Developing Mathematical Reasoning in Grades K-12. In Stiff, Lee V Curcio, Frances R (ED). *Reasoning by Analogy*. Reston: The National Council of Teacher of Mathematics. Inc.
- Soedjadi, R. (2000). *Kiat Pendidikan Matematika*

Di Indonesia, Dirjen Dikti Depdiknas, Jakarta.

## APPENDIX

Sources problems (M11): Birthday Cake
Ani wants to give a gift of a birthday cake on his birthday. Ani was not sure how much cake left, if the cake is put into a bag. At first, each pouch condition 16 cakes. It turns out the last bag there are 6 remaining cake, but Ani wanted no cake left. Then he pulled out all the contents of the bag and began to fill each bag with 14 cookies, turns on the last bag there are 6 remaining cake. At three he attempts to fill each bag with 8 cakes. Again, the cake is left on the last bag there are 6 cakes. Ani confusion, then he called his friend Ana to help resolve the problem. Ana advised to fill each bag with 9 cake, it turns out there is no more cake left. Ani excited and thanked her. What is the minimum lot Ani cakes brought in his friend's birthday party?
Target Problem (M12): Shop Building
Building a store employee would like to send customers orders ornamental stones, ornamental stones by inserting it into a cardboard box. He did not know how many pet rocks that can be contained in the boxes. At first he was put into 12 boxes, but the remaining 2 ornamental stone. The shop owner wanted no ornamental stone is left to be loaded in 1 carton. The employee then took out all the contents of the box and start to enter it into 8 boxes, but the remaining 2 ornamental stone. Even in the third step, the ornamental stone inserted into the 6 cardboard, but still remaining 2 ornamental stone. The employee was upset and reported the matter to the owner of the store. The shop owner suggested ornamental stone is inserted into the 7 boxes. The employee then insert into 7 boxes of decorative stone, was no longer remaining ornamental stone. If the decorative stones to be sent between 50 and 200. How many ornamental stones that can be sent to customers?

## SPEECH ON THE BEGINNING OF CHILDREN AGES 5 YEARS

**Perla Yualita**  
STIKes Aisyiyah Bandung  
perlayualita3@gmail.com

### **Abstract**

*This study was conducted to obtain an overview of speech in the early days of children aged 5 years. From research, it has been found that in their early days, children 5 years of age are shown to have a strong desire to speak. This is evident from the produced MLU figure of 4.9 at Post V stage (Brown Standard). This means that the ability to speak above stage V which shows that their ability has exceeded co-ordination of simple sentences. In addition, at this time the children have already been talking about their favorite activities and have mastered the basic grammar laws of their first language (L1), although in terms of phonological development they are still experiencing difficulties in pronunciation of compound and less complex consonants. At the same time, they have learned the vocabulary of abstract words, verbs, nouns, and plural words, along with the desire to give information to others.*

**Keywords:** *The beginning of children 5 years of age, MLU, First Language (L1)*

### **BACKGROUND**

In accordance with the opinion stated by Elizabeth Hurlock, the age of 2 to 6 years is the stage of early childhood. Early childhood period is the closing stage of infancy and a period of transition from dependence to growing independence. The characteristics of early childhood can be seen from the titles given by parents, educators, and psychologists. Parents call early childhood as a difficult phase that invites many problems mainly related to behavior. Parents also call it the age of playing because children at that age spend most of their time playing. According to educators, the period of 2 to 6 years of age is the preschool stage which is a time of preparation before entering school life filled with pressure and responsibility. Meanwhile, psychologists call this period with many designations, namely:

1. Group age, which is a period where the children learn the basics of social behavior as a preparation for higher social life, required for adjustment when they enter the first grade of elementary school.

2. Exploration age, because this is a time period where kids want to know the state of their environment and its mechanism, how it feels, and how they can become part of their environment.
3. Inquiry age, where children seek to explore their environment with many questions.
4. Imitation age, where kids love to imitate the speech and actions of others.
5. Creative age, a period where children show more creativity in play compared to other times in their life.

Early childhood learning is considered as the right moment to achieve a variety of skills because at this time the child likes to repeat activities that are important to learn skills. In this age range, children are venturesome and like to try new things. During early childhood, children have a strong desire to learn to speak. This is because learning to speak is the principal means of socialization and also a means to gain independence (<http://digilib.petra.ac.id>).

Furthermore, Benedict (Chaer, 2003:237) states that children around the age of 13 months have mastered about 50 words, but only around the age of 19 months can children productively utter those words.

Referring to the aforementioned opinions, the author was interested in conducting research related to children's ability to talk, especially about children's ability to produce speech. The subjects of research chosen by the author were children aged 5 years, because this age is the midpoint of early childhood where children have a strong desire to speak.

The guidelines used to calculate the amount of children's controlled speech refer to the measurement set by Roger Brown (Mar'at, 2009:60), which is known as Main Length of Utterance (MLU). MLU calculation is obtained by dividing the number of morphemes by the number of utterances produced by children. The purpose of this study is to get an idea of utterances produced in the early stages of children aged 5 years.

## METHOD

The type of research conducted was survey research. Kerlinger (Sugiyono, 1998:3) states that survey research is conducted on either a large or small population, but the studied data are data from samples taken from the population in order to find relative occurrences, distribution, and relationships between variables, both sociological and psychological.

The survey was conducted to collect data and information about a large population by using a relatively small sample. The method used was a descriptive survey method. The descriptive survey method is a research method that takes a sample of a population by using interviews and observations as data collectors.

The respondents in this study was boy aged 5 years. The instrument used in this study was a recorder used to conduct interviews and observations. Interviews were conducted unstructured/informally and recorded using a tape recorder without the knowledge of the respondent so that the data obtained are natural.

Observations were structured and unstructured. Structured observations were designed systematically concerning what will be observed, and when and where the observations take place. Unstructured observations were not prepared systematically concerning what will be observed. The results of observations were recorded in field notes.

The data analysis techniques were implemented as follows.

1. The data from recorded interviews were converted to written text.
2. The interview data were compared with the results of observations.
3. The written text was analyzed carefully.
4. The results of the text analysis were associated with the MLU theory.
5. The results of the study were summed up.

## LITERATURE REVIEW

### Child Language Acquisition

Language acquisition is the process toward the possession of the ability to speak, either in terms of understanding or expression, naturally, without going through formal learning activities. In other words, this activity is done by children unconsciously with no burden, and takes place on an informal basis and in the context of meaningful language.

Language skills in children are not obtained simultaneously. Speaking skills, for example, are acquired by a child through the following stages.

1. Pre-linguistic stage, the language development phase in which children have not yet been able to produce meaningful sounds. Resulting sounds like crying, whining, cooing, and chattering are only a means to train their articulate motions until they are able to utter meaningful words.
2. One-word stage, the language development phase where children have only been able to use one-word utterances. These one-word utterances represent complete ideas and expressions.
3. Two-word stage, the phase where children are able to use two words in their speech.
4. Multiple-word stage, the language development phase where children are able to speak with three words or more with a better mastery of grammar.

In the above stages, children's knowledge of language subsystems, such as phonology, grammar, semantics, and pragmatics, also implicitly develops. Receptive oral language skills, such as listening or understanding, are acquired by children faster than the ability to speak. When children have only been able to use speech with one word, for instance, their ability to understand would be higher. They are able to understand and respond to full and relatively long speech, and so on (<http://pustaka.ut.ac.id>).

### Language Development

The comprehension of young children sometimes goes beyond their speech. They use small children's ways in feeling and understanding their world during their development. Roger Brown believes that the Mean Length of Utterance (MLU) is a good index for assessing the maturity of a child's language. The following is the elaboration of Brown's stages which include age range, mean length of utterance, characteristics of language and sentence variations.

#### 1. Phase 1

The MLU is 1.00 to 2.00. The vocabulary primarily consists of nouns and verbs with several adjectives and auxiliaries. Word order is also shown. Characteristic phrases are "mama dada", "papa dada", and "big dog".

#### 2. Phase 2

The MLU is 2.00 to 2.50. Compound words are formed precisely, past tense, be, the, a, an are used, along with some prepositions. Characteristic phrases are "sleeping doll", "they're beautiful", and "milk runs".

#### 3. Phase 3

The MLU is 2.50 to 3.00. "Yes/No" questions start to appear, questions using who, what, where are developed, negative words (no, not, non-) are used, and so are important or imperative words

(command or request). Characteristic phrases are “Daddy home?” and “Susie not want milk.”

#### 4. Phase 4

The MLU is 3.00 to 3.75. A sentence is sometimes associated with other sentences. Characteristic phrases include, “I thought it was red,” and “Know what I saw.”

#### 5. Phase 5

The MLU is 3.75 to 4.50. Simple sentences and relations between propositions are coordinated. Characteristic phrases are “I went to Bob’s house and ate ice cream,” and “I want a rabbit as funny.” (<http://digilib.petra.ac.id>).

Mean Length of Utterance (MLU), according to Roger Brown (Bayu, 2009), is an index of language development based on the number of words per sentence generated by a child in a sample consisting of about 50 to 100 sentences, as an index of good maturity.

MLU stages :

1. 1 + 2.0
2. 2.5
3. 3.0
4. 3.5
5. 4.0

Phase 1 starts when a child creates sentences that consist of one word, the sign 1+ indicating that the average number of words in each utterance is more than one but not yet two. This phase continues until the child has an average of two words per utterance, and so on.

The development of language comprehension in a child is not only greatly influenced by the child’s biological condition, but the linguistic environment around the child from an early age is much more important in their language development, especially the role of parents and other people around the child.

Phase I	→ MLU index= 1, 75
Phase II	→ MLU index= 2, 25
Phase III	→ MLU index= 2, 75
Phase IV	→ MLU index= 3, 50
Phase V	→ MLU index= 4, 00

Robert Brown Standard (Mar’at, 2009: 65-66)

Phase 1 : Relations of rules in simple sentences

Phase 2 : Modulation (setting) of meaning in simple sentences

Phase 3 : Conversion of simple sentences

Phase 4 : Inserting a sentence into another sentence

Phase 5 : Coordination of simple sentences (grammar known)

Standard Robert Brown (Timothy, 2003)

Stage	MLU (Words)	Age Range (Months)
<b>Early I</b>	1.01 – 1.49	16 – 26
<b>Late I</b>	1.50 – 1.99	18 – 31
<b>Late II</b>	2.00 – 2.49	21 – 35
<b>Late III</b>	2.50 – 2.99	24 – 41
<b>Early IV</b>	3.00 – 3.49	28 – 45
<b>Late IV/</b>	3.50 – 3.99	31 – 50
<b>Early V</b>		
<b>Late V</b>	4.00 – 4.49	37 – 52
<b>Post V</b>	4.5 +	41 -

Schaerlaekens (Mar’at, 2009:66-67) suggests the existence of a differentiation period from 2.5 to 5 years of age in child language development which has the following characteristics.

1. At the end of the period children have generally mastered their native language, meaning that basic grammar laws obtained from adults have been mastered.
2. The development of phonology may be said to have ended. There may still be difficulties in pronouncing combined and less complex consonants.
3. Vocabulary is developed, both quantitatively and qualitatively. Some abstract concepts, such as the concept of time, space, and quantum, begin to emerge.
4. Nouns and verbs become more differentiated in use, characterized by the utilization of prepositions, pronouns, and auxiliary verbs.
5. The function of language for communication begins to actually be fulfilled, as children are able to hold conversations in a way that can be understood by adults.
6. Children start willing to share their perception and experience concerning the outside world with other people, by giving feedback, asking questions, giving orders, informing, etc.
7. Development in terms of morphology begins to occur, characterized by the emergence of plural words, changes in noun suffixes, and changes in verbs.

## RESULTS AND DISCUSSION

Analysis resulted in data as given in the following table.

No.	Situation Theme	Speech	Morpheme
1.	Going to <i>Carrefour</i>	24	132
2.	At home	36	162
	Σ	60	294

Based on the number of utterances and morphemes that has been collected, the number of Main Length of Utterance (MLU) which has been mastered by the respondents is:

$$MLU = \frac{\Sigma \text{Morpheme}}{\Sigma \text{Speech}} = \frac{294}{60} = 4.9$$

Referring to the standards set by Roger Brown (Mar'at, 2009:65-66), respondents were above stage V because the MLU value obtained was 4.9, while the reference value was 4.00. Such is also the case when referring to Roger Brown (Timothy, 2003), where respondents are in Post V stage. Post V stage shows MLU of over 4.5 at the age range of above 41 months. This suggests that the 5-year-old respondents were in a range that matches the standards set out by Roger Brown.

The figure obtained by the respondent at MLU=4.9 demonstrates an ability above phase V. This means that the ability has exceeded the coordination of simple sentences. This is evidenced by the statement of Schaerlaekens (Mar'at, 2009: 66-67), which suggests that the differentiation period of 2.5 - 5 years of age has the following characteristics.

1. At the end of the period children have generally mastered their native language, meaning that basic grammar laws obtained from adults have been mastered. It can be seen from the utterances of respondents who have Indonesian as L1.
2. The development of phonology may be said to have ended. There may still be difficulties in pronouncing combined and less complex consonants, as in the word *carrefour* pronounced as *kerpur* (utterance 1), *okky jelly drink* as *oki jeli ding* (utterances 2, 3), *championship* as *chempionsip* (utterance 11), *computer* as *tongpitter* (speech 41), *dinding* as *dingding* (utterance 33), and *oranye* as *oren* (utterance 58).
3. Vocabulary is developed, both quantitatively and qualitatively. Some abstract concepts, such as the concept of time, space, and quantum, begin to emerge, as in the phrase *nggak lama* (utterance 8) which states time, and *pulang siang* (utterance 20).
4. Nouns and verbs become more differentiated in use, characterized by the utilization of prepositions, pronouns, and auxiliary verbs, as in *di situ* (utterance 27), and *gak bisa liat* (utterance 55).
5. The function of language for communication begins to actually be fulfilled, as children are able to hold conversations in a way that can be understood by adults. This is evident from the fact that the communication process went smoothly without any obstacles.
6. Children start willing to share their perception and experience concerning the outside world

with other people, by giving feedback, asking questions, giving orders, informing, etc., such as the speech *Suka sama mamah pake odol Kodomo oren*. Here the respondent intended to inform that he was happy to brush his teeth using orange-colored Kodomo toothpaste.

7. Development in terms of morphology begins to occur, characterized by the emergence of plural words, such as *angka-angkanya* (utterance 12), and changes in verb suffixes, such as *dinyalakin* (utterance 42).

At this stage the respondent began to talk about his favorite activities, such as eating and drinking his favorite things (utterances 2-6), watching his favorite movie (utterances 26, 29-31), playing his favorite game (utterances 11-15, 26, and 41), mentioning the title of his favorite song (utterances 33, 35, and 36), and mentioning his favorite book (utterances 38-40).

## CONCLUSION

Based on the research on the overview of speech produced in the early stages of children aged 5 years, the following conclusions are obtained:

1. Children aged 5 years in the middle of early childhood are shown to have a strong desire to speak. This is evident from the produced MLU figure of 4.9 which is at Post V stage (Brown Standard). This means that the child has ability above phase V which demonstrates that his ability has exceeded the coordination of simple sentences.
2. At this stage the respondent began to talk about his favorite activities, such as eating and drinking his favorite things (utterances 2-6), watching his favorite movie (utterances 26, 29-31), playing his favorite game (utterances 11-15, 26, and 41), mentioning the title of his favorite song (utterances 33, 35, and 36), and mentioning his favorite book (utterances 38-40).
3. Referring to the opinion of Schaerlaekens (Mar'at, 2009:66-67), obtaining 4.9 (age 2.5 - 5 years) implies that at this age children have generally mastered basic grammar laws in their L1 although in terms of phonological development they are still experiencing difficulties in pronunciation of compound and less complex consonants. At the same time, they have learned the vocabulary of abstract words such as time, verbs, nouns, and plural words, along with the desire to give information to others.

The results of this study can be used to contribute to the science of nursing, especially child nursing. By taking into account the child's language



skills, especially at the age of 5 years, it is expected nursing care in children can be performed more optimally.

#### References

- B. Jay, Timothy. 2003. *The Psychology of Language*. Pearson Education Asia Limited and Peking University Press, China.
- Bayu. 2009. *Perkembangan Kognitif pada Masa Bayi* [Online]. Available: [sejuk-pagi.blogspot.com/.../perkembangan-kognitif-pada-masa-bayi.html](http://sejuk-pagi.blogspot.com/.../perkembangan-kognitif-pada-masa-bayi.html) [1 June 2010].
- Chaer, Abdul. 2003. *Psikolinguistik Kajian Teoretik*. Jakarta: PT. Rineka Cipta.
- Mar'at, Samsunuwiyati. 2009. *Psikolinguistik Suatu Pengantar*. Bandung: PT. Refika Aditama.
- Sugiyono. 1998. *Metode Penelitian Administrasi*. Bandung: Alfabeta.
- Nn. 2006. *Active Learning*. [Online] Available: [http://digilib.petra.ac.id/.../jiunkpe-ns-s1-2006-42402017-4865-active\\_learning\\_chapter2.pdf](http://digilib.petra.ac.id/.../jiunkpe-ns-s1-2006-42402017-4865-active_learning_chapter2.pdf)
- Nn. ----- [Online] Available: [http://pustaka.ut.ac.id/puslata/online.php?menu=bmpshort\\_detail2&ID=303](http://pustaka.ut.ac.id/puslata/online.php?menu=bmpshort_detail2&ID=303).
- Nn. ----- [Online] Available: [http://pustaka.ut.ac.id/puslata/online.php?menu=bmpshort\\_detail2&ID=265](http://pustaka.ut.ac.id/puslata/online.php?menu=bmpshort_detail2&ID=265).

## IMPROVING JUNIOR HIGH SCHOOL STUDENTS SCIENCE LITERACY BY USING MULTIMEDIA ON INTEGRATED-SCIENCE LEARNING IN THEME OF TRASH AND ITS TACKLING EFFORT

Dewi Nurdianti  
Banu Kisworo  
Tania Avianda Gusman

Chemistry Departement, Teacher Training and Education Faculty  
University of Muhammadiyah Cirebon

Email: dewinurdianti@yahoo.co.id, kisworo.banu@yahoo.com, nia\_inu@yahoo.com

### Abstract

*To improve students' science literacy on integrated-science learning in the theme of trash and its tackling effort by using multimedia was done by comparing the result of students' science literacy increment which is referred to PISA between those who are learning through video and animation and those who are learning through power point slides. The sample of this research is 60 students of VII grade of Junior High School (SMP0 6 Cirebon. During the teaching learning process, the experimental group was taught by using video and animation whereas the controlled group was taught by using power point slides. Pre-test and post-test control group design are used to execute quasi-experiment design. Based on the result of the observation, teacher had conduct appropriately with the lesson plan in which the step of learning which had most of students' active response was nexus step. In this step, 66,7% of the students delivered their opinion and 83,3% of the students answered the question. Based on the result of analysis, there was a significant increment of students' science literacy of experimental group compared to the controlled group. This is proven by % N-Gain of experimental group which reached 48,6% whereas 25,2% for controlled group. The highest increment is on the science content aspect which reached the number of 44,14%. From t-Test, mean disparity 5 N-Gain at  $\alpha = 0,05$  with P-value/sig. 0,000 indicates that using multimedia on integrated-science learning in the theme of trash and its tackling effort can improve students' science literacy more significantly than using power point slides.*

**Key words:** Integrated Science, Trash and its tackling effort, Multimedia, Science Literacy.

### INTRODUCTION

PISA-OECD reflected that the improvement Indonesian young learners' science literacy which measured in National PISA 2006 is still in lower

level, it is 29% as the content, 34% in the process, and 32% in the context, comparable by the improvement in International PISA literacy. This lowered science literacy is because of the factor of learning process where it is still using teacher centered learning, whereas the students' activities can be told that they only hear the explanation from the teacher and take important notes (Mahyudin, 2007), so that the students only learn science as the product but process, attitude, and application. The content being taught is not related with their daily activities, and also the learning process is still not integrated however we used Integrated Science as the name of the subject. It is not the same with the learning process that should be applied by Depdiknas which more pressed by giving direct experience to develop the competence to comprehend the nature naturally (Depdiknas, 2006).

Science literacy learning is a learning based on developing of science skill knowledge in every part of life, finding the solution of problems, making the decision, and improving the quality of life. (Holbrook dan Rannikmae dalam Holbrook, 1998). The goal is to improve creative skill used the knowledge and to know the application in daily life to solve the problems and to make decision that can improve life quality. (Holbrook dan Rannikmae dalam Holbrook 1998). Integrated science learning based literacy science is not only improving students' motivation, but also improving the content of subject, the process, application context, and students science attitude, Sumatati (2009). From the six of science literacy learning stages, the most stage which gets more positive response is nexus stage (Nurdianti, 2012).

Multimedia in the learning process can be defined as the combination of many media involves text, graphic, audio, photo, and animation (Samodra, *et al.*, 2009). The use of multimedia in the learning process give the opportunity to the students to learn not only from one source of learning such as teacher, but also give them to improve their cognitive better, creative and

innovative (Saguni, 2006). It happened because of the information is delivered by visual, verbal and audio. (Mayer dan Moreno, 1998). It is also can attract students' attention in a subject (Wiendartun, *et. al.*, 2007).

The making of video and animation as the multimedia in this research by adopting the research done by Samodra, D., W, dkk, 2009 it was used design instructional model / development model gather with the approached system. This design generally recommended the activities logically include the analysis, design, development, implementation and evaluation (ADDIE). Based on the explanation above, so that this research is done to improve the students' science literacy by making the video and animation as the multimedia in the integrated-science learning in theme of trash and its tackling effort.

## RESEARCH METHOD

This research is an experimental research by designing control group pre test and post test. This research subject is the seventh grade of Junior State High School 6 Cirebon which has 60 students and divided in two groups, they are experimental group (used video and animation as the multimedia) and control group (used power point). The data in this research is from the use of instruments includes multiple choice test, it is to know the improvement of students' science literacy, observation sheet, it is to know the application of learning process and students science attitude and interview to know the students' response of the learning process.

## RESULT AND DISCUSSION

### Implementation of The Learning Process

#### 1. The Contact Step

The activities undertaken at this step is the teacher divided the students into groups, then the teacher showed a video about the garbage and its consequences. Thereafter, the teacher is guiding students had discussion related to learning content ( properties of matter, biotic and abiotic components). By the time the teacher has been carrying out learning activities in accordance with the RPP. At this step, the number of students who show an active response of 27,6% is still a bit to answer the question, and 0% for the giving question then the remaining of students are prefer discuss with his friend and nothing to do. When the video is played so the student listen and pay attention to the video. Based on the interview of the lower active response because they are unfamiliar with the presence of the researcher as teacher and observer and also with the multimedia is the new things that they got in the school.

#### 2. The *Curiosity* Step

In this step, the teacher increase the curiosity of students by asking the question "How can the right to process waste in accordance with the nature of garbage"? Respon active students at this step is still not up to 36, 7% and 10% for the answer to question. At this step, students prefer is asking the teacher together with his friends than answer the question by himself. From the interview is known that they have appeared curious and they want to ask but they are still afraid to ask.

#### 3. The Elaborasi Step

In this step the student observation directly of the garbage sample and write the observations on the worksheet provided. These observations include the type, nature, amendment and biotic and abiotic components that exist in the trash. After observation, the student guided by the teacher to discuss the types, properties, and changes in biotic and abiotic components that exist in the trash were observed. After that, the students are given impressions back on how waste management and appropriate based on the nature of the material changes as well as biotic and abiotic components that are involved in it. When the video is played, the student is watching carefully . Response aktif students at this step is increasing up to 63.3% and 50% answered the question to ask. At this step, the teacher makes a fun discussion so that the students more active than the previous step.

#### 4. The Decision Step

At this step, the teacher is guiding students to associate with the waste material that is taught so that students can determine the appropriate method of processing waste for each samples were observed. At this step, the number of active responses of students increased from the previous stage is 83.3% for answer the questions of teachers and 56% of expression. From the interview, it is known that students are getting used to the discussions and started growing his confidence so they dare to argue and answer questions individually.

#### 5. The Nexus Step

At this step, students are guided to take the essence of learning (decontextualization) and apply it to another context (re-contextualization) by watching videos and discussion. Number of active student response to answer the question is increased up to 83.8%, 66.7% to express opinions and the asking questions is decreased up to 10%. Based on interviews that the declining number of students because they already understand the material of the teacher is taught.

#### 6. The Evaluation Step

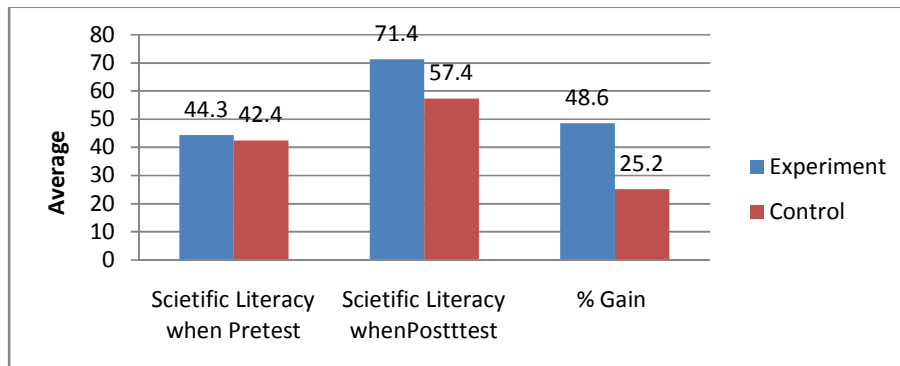
At this step, the students is taking the test to determine the increasing of scientific literacy with eventhough there are still students who working together.

From the observation of the feasibility study using a multimedia Integrated Sciences is known that teachers are already implementing the learning activities in accordance with the RPP and the teacher can also put the condition as a facilitator during discussions that stimulate students to be active. In the learning process that students are enthusiastic with animated video show by the teacher, they feel attracted by the display so that students focus more on learning. The step of the most active response is nexus where the number of students expressing their opinions as much as 66.7% and the students who answered the question as much as 83.3%. At this step students have a concepts is being taught and the context provided outside from the context of the theme is close to daily life of the students.

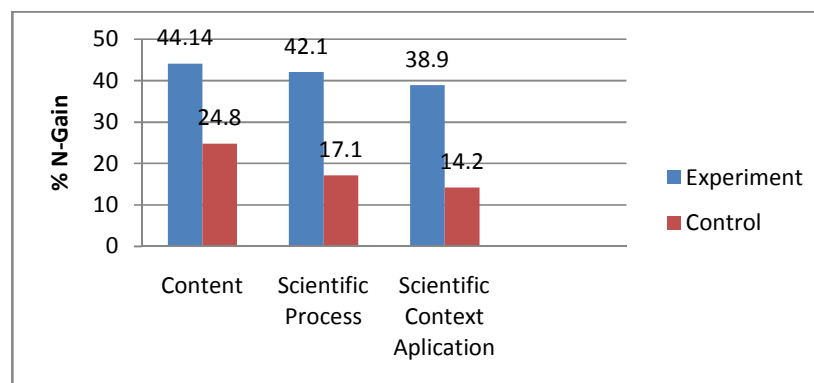
### Students' Science Literacy Improvement

Students' science literacy improvement in the aspect of content, process and science application context are from the use of test instrument involve the multiple choice test based on PISA criteria. The result of pre test, post test and % N-Gain for control and experimental class can be seen in picture 1. It can be seen that the result of post test and % N-Gain in experimental class is bigger than in control class, this is proved that the class which used video and animation as the multimedia is succeed to get the higher achievement than in the control class which used power point.

The improvement in students' science literacy in every aspect (the aspect of content, process and the context of science application) can be seen in the picture 2.



Picture 1. The result of pre test, post test and %N Gain



Picture 2. The improvement of science Literacy in every aspect.

### Normality and Homogeneity Test

After getting the data of pre test, post test and %N-Gain, then tested the normality and homogeneity to those data. Table 1 showed the

normality test and table 2 showed the result of homogeneity in the pre test, post test and % N-Gain.

**Tabel 1. Normality Data *Pretest*, *Posttest*, and *N-gain* Result**

	<i>Pre Test</i>		<i>Post Test</i>		<i>%N-gain</i>	
	Exsperimental Class	Control Class	Eksperimental Class	Control Class	Eksperimental Class	Control Class
P-value/Sig.	0,112	0,11	0,015	0,033	0,193	0,022
Conclusion	Normal	Normal	Normal	Normal	Normal	Normal

The test is done in significance of level 95% ( $\alpha = 0,05$ ) by the criteria if  $-value/Sig > \alpha$  so the data is normal distributed.

**Tabel 2. Homogeneity Data *Pretest*, *Posttest*, and *N-gain* Result**

	<i>Pre Test</i>	<i>Post Test</i>	<i>N-gain</i>
P-value/Sig.	0,700	0,981	0,736
Conclusion	Homogeny	Homogeny	Homogeny

The test is done in significance of level 95% ( $\alpha = 0,05$ ) by the criteria if  $-value/Sig > \alpha$  so experimental and control class are homogeny. The homogeneity data showed that the sample that used in this research is having the same skill between the experimental and class control. This is the same with the statement of Ruseffendi (1994) who stated that the equivalence of research subject in the different group should be appeared in order to get the difference of the result in each group, not only because of those groups is not equivalence but also there is a difference treatment, in this case is because of different media.

#### **t -Test**

To know whether there is different science literacy in pretest, posttest and the improvement of experimental and control class so it is done the t Test because the three data are normal and homogeny distributed. T test is done in the significance of level 95% ( $\alpha = 0,05$ ) with the criteria if  $P-value/Sig < \alpha$  so that there is a significant differential in science literacy in experiment and control class. The result of t test to improve science literacy can be seen in table 3, as follow:

**Tabel 2. The result of t-test of science Literacy in Pretest, post test and % N Gain**

	<i>Pretest</i>	<i>Posttest</i>	<i>% N-Gain</i>
P-value/Sig.	0,484	0,000	0,000
Conclusion	There is not significant different	There is a significant different	There is a significant different

Based on the data in table 2 known that science literacy in the pretest of both groups is not a different significant. Meanwhile in there is a significant different in result of post test and %N Gain. Multimedia in the form of video and animation in integrated learning Science in Garbage as the theme and the effort to tackle it, is the media that can be seen and heard and it is also can improve students' science literacy comparing by using power point that only applied pictures and text. It emphasized that picture, animation, video and attracted concept will be easily memorized for the students better comparing by visualizing the subject with text and pictures (Wiendartun, et. al., 2007).

#### **CONCLUSION**

Based on the six stages science literacy, the most stage that gets more active response is nexus stage, the result of nexus stage is 66,7 % students gave the opinion and 83,3% answered the questions. Teacher has been done the learning process as it applied in the lesson plan.

Integrated-science learning in theme of trash and its tackling effort by using video and animation can improve students' science literacy better than its learning by using power point. The biggest science literacy is achieved in experimental group based % N-Gain is 48,6 % and control group 25,2 %, the biggest improvement happened in the aspect of science content, it is 44,14 %. From t test there is average different % N-Gain in  $\alpha = 0,05$  with P-value/Sig. 0,000 that showed a significant different

in % N-Gain between experiment and control group.

## References

- Depdiknas. (2006). *Contoh/Model Silabus Mata Pelajaran Ilmu Pengetahuan Alam*. Direktorat Pembinaan SMP: Badan Standarisasi Nasional Pendidikan.
- Holbrook, J. (1998). *A Source Book for Teachers of Science Subjects*. UNESCO.
- Mayer, R. E., & Moreno, R., (1998). *A splitattention effect in multimedia learning: Exidence for dual processing systems in working memory*. Journal of Educational Psychology, 90, 312-320.
- Nurdiyanti, Dewi. (2012). *Pembelajaran IPA Terpadu pada Tema Sampah dan saha Penanggulangannya untuk Meningkatkan Literas Sains Siswa SMP*. Jurnal Redoks, Volume 1 Nomor 1.
- OECD-PISA. (2006). *Science Competencies for Tomorrow's World*. Volume 1: Analysis. USA: OECD-PISA.
- Ruseffendi, E.T. (1994). *Dasar-Dasar Penelitian Pendidikan dan Bidang Non-Eksakta Lainnya*. Semarang : IKIP Semarang Press.
- Saguni, F. (2006). *Prinsip-Prinsip Kognitif Pembelajaran Multimedia: Peran Modality dan Contiguity Terhadap Peningkatan Hasil Belajar*. Jurnal INSAN. Vol. 8 No. 3
- Samodra. D.W., Suhartono, V., Santosa, S. (2009). *Multimedia Pembelajaran Reproduksi Pada Manusia*. Jurnal Teknologi Informasi, Volume 5 Nomor 2, ISSN 1414-9999
- Sumartati, Losarini. (2009). *Pembelajaran IPA Terpadu pada Tema "Asupan Makanan dan Pengaruhnya Terhadap Kerja Ginjal" untuk Meningkatkan Literasi Sains Siswa MTs*. Tesis pada SPS UPI Bandung: tidak diterbitkan.
- Wiendartun, Taufik Ramlan Ramalis, Hery Saeful Rochman. (2007). *Pengaruh Pembelajaran Berbasis Multimedia Terhadap Hasil Belajar Fisika*. Proceeding of The First International Seminar on Science Education ISBN: 979-25-0599-7

## EFFECT OF TIME AND TEMPERATURE ON ULTRASOUND ASSISTED EXTRACTION OF ANTIOXIDANT FROM *Coleus tuberosus*

Albertus Adrian Sutanto<sup>\*</sup>), Yustian Suharto, and Hadiyanto

Chemical Engineering Department, Faculty of Engineering, Diponegoro University  
Jl. Prof. Sudharto, SH, Tembalang, Semarang, 50275, Phone/Fax: +62 247460058

<sup>\*</sup>Corresponding author: adrian.albertus@gmail.com

### Abstract

*Coleus tuberosus*, in Indonesia known as “black potatoes”, is one of the crops that contain antioxidant such as ursolic acid and oleanolic acid, has a potential as a cancer medicine. *Coleus tuberosus* peel has higher antioxidant content than its flesh. The antioxidant from *Coleus tuberosus* can be taken by ultrasound assisted extraction (UAE). This research will study the effect of temperature and time on the activity of antioxidants that can be extracted from the *Coleus tuberosus* peel. Experiment begins with the preparation of raw materials, then extraction is done by ultrasonic method with variation of temperature and time. The antioxidant activity of extract obtained was analyzed using DPPH method. The results show that increasing temperature and time will increase the antioxidants activity. The higher antioxidant activity corresponds to the higher antioxidant content can be extracted from *Coleus tuberosus* peel extract. Extract obtained by 60 minutes of extraction time and 60°C of extraction temperature showed the highest antioxidant activity compared to any other variables with 89.35% of antioxidant activity.

**Keywords:**ultrasound, extraction, antioxidant, *Coleus tuberosus*, peel, ursolic acid, oleanolic acid

### INTRODUCTION

Cancer is a disease which is characterized by abnormal cell cycle, and the cell ability to grow uncontrolled, attacking nearby biologic cell, and migrate to other organs via blood circulation or lymphatic system. Environmental factors are very influential as one of the causes of cancer. Unhealthy environmental danger include free radical, is a molecule, atom, or group of atoms that have several unpaired electrons and become reactive free radical. Free radical like this is very

dangerous because it can steal electrons from other compounds such as protein, lipids, carbohydrates, and DNA in human body (Amelia, 2006). DNA is a compound present in the nuclei of cells. When DNA damaged, it can lead to wide range of degenerative diseases, one of which is cancer

Generally, cancer cause death and become one of the main causes of death in developing country. Cancer is a serious threat for public health in Indonesia. Based on data from Ministry of Health in 2007, the amount of cancer patients in Indonesia reach 4.3 per 1000 population. According to WHO, in 2030 there will be a surge in the number of patients in Indonesia until seven times from now. In addition, the number deaths caused by cancer in Indonesia ranks as the sixth leading cause of death in Indonesia.

One of the effective way to counter cancer is consume antioxidant. Antioxidant function is as a catcher of free radicals, forming complexes compound with pro-oxidant metals, and as a reductor (Ayuningrat, 2009). Antioxidant gives on or more of its electrons to free radicals, so it can stop the damage caused by free radicals (Praptiwi et al., 2006).

Naturally, our bodies produce antioxidants used to protect the body from various diseases. However, the production of natural antioxidants in the body will decrease to 50% at the age of 40 years. So, supply of antioxidants from outside source is needed to improve antioxidant level in our body (Amelia, 2006). Based on the source, antioxidants can be divided into natural antioxidants and synthetic antioxidant. However, synthetic antioxidants have negative side effects on health so that antioxidants from natural products, such as fruits and vegetables are usually more desirable, because of better security level and wider benefits.

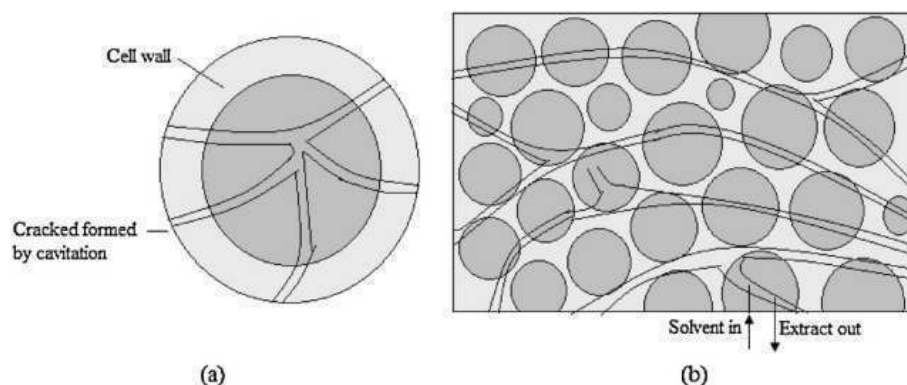


Fig. 1 The mechanism of cell wall disruption in ultrasound assisted extraction (a) breaking of cell wall due to cavitation, (b) diffusion of solvent into the cell structure (Shirsath et al., 2012)

One of the crops that could potentially have antioxidant is *Coleus tuberosus*, in Indonesia also known as black potato. *Coleus tuberosus*, vegetables from the *Lamiceae* family. One of the characteristics possessed by bioactive compounds of plants of the family *Lamiaceae*, especially of the subfamily of *Nepetoideae*, is the presence of triterpenic acid. There are two types of triterpenic acids contained in *Coleus tuberosus*, ursolic acid and oleanolic acid (Nugraheni et al., 2010). In the field of biology and pharmacology, triterpenic acid is used as a source of antioxidants, anti-tumor, and immune system enhancement (Nugraheni et al., 2010). In research conducted by Nugraheni et al. (2011), both flesh and skin from black potato contain ursolic acid and oleanolic acid. However, the black potato skins contain more antioxidants than the flesh. Ursolic acid and oleanolic acid have proven to inhibit the growth of cancer cells (Nugraheni et al., 2011). Triterpenic acid compounds in black potatoes can be obtained by extraction, one of them is ultrasound assisted extraction.

Extraction is a separation operation of a solute in a mixture using another separating agent called solvent. The basic principle of extraction is based on differences in solubility (Utami et al., 2009). To separate solutes of diluent, the mixture is contacted with a solvent. After the contact, the solute will diffuse from the diluent to solvent resulting in separation. Based on the phases involved, there are two types of extraction, liquid-liquid extraction and solid-liquid extraction. According to Nasir et al. (2009), the factors that affect the extraction process are the operating temperature, extraction time, solvent type, as well as the size, shape, and condition of the solid particles.

Ursolic acid and oleanolic acid extraction from a mixture can be done by ultrasound. Ultrasound assisted extraction (UAE)

may enhance the extraction efficiency due to disruption of cell walls, particle-size reduction, and enhancing mass transfer of the cell contents as a result of cavitation bubble collapse (Xia et al., 2012). The mechanism of cell wall disruption in ultrasound assisted extraction can be seen on Fig. 1. This phenomenon causes physical effects, such as increasing circulation and turbulence, hence the mass transfer rate increases. Ultrasound assisted extraction (UAE) is also capable of destroying the plants' cell walls of the material, which will be extracted so it can increase the mass transfer in the extraction process (Vetal et al., 2013). Therefore, in this study, it is done to investigate the effect of time and temperature used on antioxidant activity from the extract obtained from *Coleus tuberosus* peel.

## MATERIALS AND METHODS

### Materials and Apparatus

The materials used were *Coleus tuberosus* peel, methanol as a solvent, DPPH (diphenylpicrylhydrazil) as a reagent to test the antioxidant activity. The ultrasound assisted extraction was carried out in an ultrasonic cleaning bath (Branson 2510E-DTH) with ultrasonic power of 100W and frequency of 42kHz.

### Preparation of Raw Material

*Coleus tuberosus* was washed to remove any dirt from its skin. *Coleus tuberosus*' skin was peeled to  $\pm 1$  mm thick using a potato peeler. The peel then dried in an oven for 24 hours at 40°C. After the drying process was done, the peel was ground using a blender.



### Ultrasound Assisted Extraction

The extraction was carried out in an erlenmeyer flask. Solid to solvent ratio used in the extraction was 1:75 (w/v) and the solvent used was methanol. The bath temperature was varied from 30 to 60°C and the extraction time was varied from 30 to 60 minutes. The extract was then filtered and concentrated into 25 mL. The extract was stored in the refrigerator for further analysis.

### Determination of Antioxidant Activity

#### DPPH (diphenylpicrylhydrazil) method

The assay was based on the DPPH method of Celli et al. (2011). 100µL of crude extract were added to 3.9 mL of 60µM DPPH solution. After 30 minutes of incubation in the dark at room temperature. The absorbance then was measured at 515 nm. The antioxidant activity can be calculated according to the following formula :

$$\text{Antioxidant activity (\%)} = \left[ 1 - \left( \frac{\text{Absorbance sample}_{t=30}}{\text{Absorbance control}_{t=0}} \right) \right] \times 100\%$$

## RESULTS AND DISCUSSION

### Effect of Time

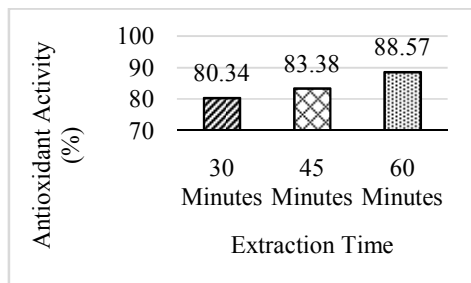


Fig. 2 Antioxidant Activity of *Coleus Tuberosus* Peel Extract on Various Extraction Time (Temperature : 45°C, Solvent : Methanol, Solid to Solvent Ratio 1:75 (w/v))

The effect extraction time on the antioxidant activity of *Coleus tuberosus* peel extract was investigated at various extraction time (30, 45, 60 minutes). The extraction was done at 45°C using methanol as a solvent and solid to solvent ratio used was 1:75 (w/v). The result is shown on Fig. 2. It is found that the longer extraction time, the higher antioxidant activity of *Coleus tuberosus* peel extract. The longer extraction time gives the longer contacting time between solvent and solute, therefore the higher antioxidant (ursolic acid and oleanolic acid) extracted from *Coleus tuberosus* peel. The yield of an extraction increases as the extraction time increases (Petigny et al., 2013). The

higher amount of antioxidant can be extracted from *Coleus tuberosus* peel extract corresponds to the higher antioxidant activity of the extract (Nugraheni, 2011).

### Effect of Temperature

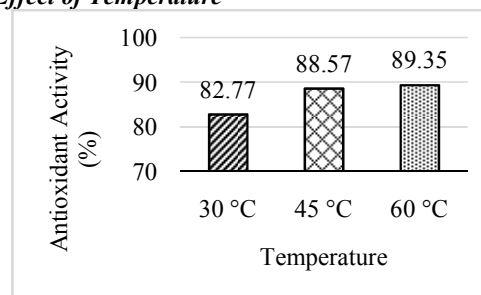


Fig. 3 Antioxidant Activity of *Coleus Tuberosus* Peel Extract on Various Extraction Temperature (Time : 60 minutes, Solvent : Methanol, Solid to Solvent Ratio 1:75 (w/v))

The temperature effect on the antioxidant activity of *Coleus tuberosus* peel extract was investigated over temperature range 30-60°C. The extraction was done during 60 minutes using methanol as a solvent and solid to solvent ratio used was 1:75 (w/v). The result is shown on Fig. 3. It is found that the temperature rise causes the antioxidant activity of *Coleus tuberosus* peel extract increases. The solubility of ursolic acid and oleanolic acid increases as the temperature increases, therefore the antioxidant content in the solvent will increase as the temperature increases (Fan et al., 2011).

In addition to the solubility, the diffusion of ursolic acid and oleanolic acid increases due to reduction of solvent viscosity as the temperature increases (Vetal et al., 2013). The higher diffusion of ursolic acid and oleanolic acid, the higher mass transfer occurs from *Coleus tuberosus* peel's cells to the solvent, therefore the antioxidant content in the solvent will increase as the temperature increases (Xia et al., 2012). The higher antioxidant content corresponds to the higher antioxidant activity of the extract (Nugraheni, 2011).

In spite of that, there is temperature limitation in the extraction of ursolic acid and oleanic acid from *Coleus tuberosus* peel, because the ursolic acid and oleanic acid is thermally stable up to 70°C (Xia dkk., 2012). The ursolic acid and oleanic acid starts degraded if the extraction temperature is more than 70°C.

## CONCLUSION

The results from this study showed the effect of time and temperature of extraction on the antioxidant activity of the extract obtained. The longer extraction time gives the longer contacting time between solvent and solute, therefore the higher antioxidant (ursolic acid and oleanolic acid) extracted from *Coleus tuberosus* peel. The higher extraction temperature, causes the higher solubility of ursolic acid and oleanolic acid and reduces the solvent viscosity. Extract obtained by 60 minutes of extraction time and 60°C of extraction time showed the highest antioxidant activity compared to any other variables with 89.35% of antioxidant activity.

## References

- Amelia, Gusmeta, (2006), Potensi Rumput Mutiara (*Hedyotis corymbosa* (L.) Lam.) Sebagai Antioksidan Alami, Institut Pertanian Bogor.
- Ayuningrat, Eka, (2009), Penapisan Awal Komponen Bioaktif dari Kijing Taiwan (*Anodonta woodiana* Lea.) sebagai Senyawa Antioksidan, Institut Pertanian Bogor.
- Celli, Giovana Bonat, Adaucto Bellarmino Pereira-Netto, and Trust Beta, (2011), Comparative analysis of total phenolic content, antioxidant activity, and flavonoids profile of fruits from two varieties of Brazilian cherry (*Eugenia uniflora* L.) throughout the fruit developmental stages, Food Research International, 2011, 44, pp. 2442-2451.
- Fan, Jie-Ping, Tao Kong, Lu Zhang, Sheng Tong, Zhe-You Tian, Yong-Hua Duan, and Xue-Hong Zhang, (2011), Solubilities of Ursolic Acid and Oleanolic Acid in Four Solvents from (283.2 to 329.7) K, *J. Chem. Eng. Data*, 2011, 56 (5), pp. 2723–2725.
- Nasir, Subriyer, Fitriyanti, and Hilma Kamila, (2009), Ekstraksi Dedak Padi Menjadi Minyak Mentah Dedak Padi (Crude Bran Oil) dengan Menggunakan Pelarut n-Hexane dan Ethanol, *Jurnal Rekayasa Sriwijaya*, No. 1 Vol. 18, March 2009.
- Nugraheni, M., Santoso U., Suparmo, and Wuryastuti H., (2010), In vitro antioxidant, antiproliferative and apoptosis effect of *Coleus tuberosus* L., *African Journal of Food Science*, 2010, 5(4), pp. 232 - 241.
- Nugraheni, M., Santoso U., Suparmo, and Wuryastuti H., (2011), Potential of *Coleus tuberosus* as an Antioxidant and Cancer Chemoprevention Agent, *International Food Research Journal*, 2011, 18 (4), pp. 1471-1480.
- Petigny, Loïc, Sandrine Périno-Issartier, Joël Wajsman, and Farid Chemat, (2013), Batch and Continuous Ultrasound Assisted Extraction of Boldo Leaves (*Peumus boldus* Mol.), *International Journal of Molecular Sciences*, 2013, 14, pp. 5750-5764.
- Praptiwi, Dewi P. and Harapini M., (2006), Nilai Peroksida dan Aktivitas Anti Radikal Bebas Diphenyl Picril Hydrazil Hydrate (DPPH) Ekstrak Metanol Knema laurina, *Majalah Farmasi Indonesia*, 2006, 17(1), pp. 32-36.
- Sirsath, S.R., S.H. Sonawane, and P.R. Gogate, (2012), Intensification of extraction of natural products using ultrasonic irradiations – A review of current status, *Chemical Engineering and Processing*, 2012, 53, pp. 10-23.
- Utami, T. S., Arbianti, R., Hermansyah, H., Reza, A., and Rini R., (2009), Perbandingan Aktivitas Antioksidan Ekstrak Etanol Daun Simpupur (*Dillenia indica*) dari Berbagai Metode Ekstraksi dengan Uji ANOVA, *Seminar Nasional Teknik Kimia Indonesia*, Bandung, 19-20 Oktober 2009.
- Vetal, Mangesh D., Vikesh G. Lade, and Virendra K. Rathod, (2013), Extraction of ursolic acid from *Ocimum sanctum* by ultrasound: Process intensification and kinetic studies, *Chem. Eng. Process.*, 2013.
- Xia, En-Qin, Ying-Ying Yu, Xiang-Rong Xu, Gui-Fang Deng, Ya-Jun Guo, and Hua-Bin Li, (2012), Ultrasound-assisted extraction of oleanolic acid and ursolic acid from *Ligustrum lucidum* Ait, *Ultrasonics Sonochemistry*, 19 (2012), pp. 772-776.

## WASTE WATER TREATMENT IN TOFU INDUSTRY BY USING MICROALGAE *Nannochloropsis* Sp

Ali Makrup, Mutiara C and Widayat

Department of Chemical Engineering Diponegoro University  
Prof. Soedarto, SH street, Tembalang, Semarang.  
Makrup.tekim10@gmail.com

### Abstract

Indonesia as a producer of tofu generated more liquid waste. Treatment liquid waste of tofu using aerobics and anaerobic method still have some weakness. Cultivation of microalgae *Nannochloropsis* sp on tofu liquid waste can be treated perfectly and potentially as a biodiesel feedstock. Cultivation carried out for 10 days at different percent volume of tofu liquid waste showed that the more volume of tofu liquid waste make the longer process decipherment of polymer compounds in the waste, that's make the growth rate of *Nannochloropsis* Sp. are slowness. But, an increasing in percent volume of liquid waste can be improve the decrease of COD. Variable of 20%V has the fastest growth rate with the ability to decrease levels of COD up to 77.40%. While, 60%V Variable is capable of lowering the levels of COD up to 82.35% but slow in growth.

**Keywords:** Waste, Tofu, *Nannochloropsis* Sp, Cultivation, COD

### 1. INTRODUCTION

Indonesia is one of the tofu producers that quite productive either home or industrial scale with a number of industry reached 84.000 business units with a production capacity around 2.46 million ton/year. Tofu Industry generated for liquid waste which is forecast to reach 20 million cubic meter (m<sup>3</sup>) every year. The amount of liquid waste from 1 kg of soybean each process is an average of 45 litres (Nurhasan and Pramudyanto, 1987; Barbosa et al., 2006; Tang and Ma, 2009). Liquid waste contained nutrient are very useful in the cultivation process for the production of microalgae.

At this time, tofuliquid waste treatment by anaerobic and aerobic methods. However, both of those method have several weakness. Anaerobic process have a weakness that is not able to eliminate nitrogen and phosphor, and requires the addition of a base for setting the basicity (Metcalf and Eddy, 2003). Aerobic method is able to eliminate the organic level and nutrients, but

produces CO<sub>2</sub> and active mud that is the result of tofu waste treatment (Hongyang dkk., 2011).

To resolve the problem, there are methods that can be solved tofu liquid waste as medium cultivation microalgae. Some microalgae are not only able to remove the pollutant, but also able to produce lipids, which can be converted into biodiesel (Perez-Garcia et al., 2012; Bhatnagar et al., 2010; Li et al., 2008). A Microalgae *Chlorella pyrenoidosa* including, *Scenedesmus obliquus*, *Chlorella* and *Spirulina platensis*, *minutissima* (Hongyang dkk., 2012; Martinez et al., 2000; Bhatnagar et al., 2010; Yang dkk., 2008). That microalgae are able and effective to remove the pollutant in the waste, but have a low productivity, low lipid content and intolerant in extreme environment condition (Hongyang dkk., 2012; Chisti, 2007).

Selection of microalgae for cultivating will depend heavily on the ability to remove the pollutants, easy of adapting to the environment and productivity of lipids. *Nannochloropsis* Sp. is microalgae which able to producing up to 68% of lipids (dry base) and tolerant with environmental conditions (Chisti, 2007). The large lipid levels can be converted into one of the alternative biodiesel energy. Biodiesel is one of the potential alternative fuel to supply even replace petroleum diesel because it has a similar characteristics (Hambali, 2006).

Cultivation system of microalgae requires medium are have enough nutrients for the growth. Tofu liquid waste have nutrients that are still useful and does not have toxic and hazardous substance, so the liquid waste can be used as a medium of cultivation. Because of cultivation are important, then conducted research to know the growth rate and decrease in the levels of organic COD on cultivation microalgae types of *Nannochloropsis* Sp. in medium tofu waste liquid.

### 2. FUNDAMENTAL THEORY

Some research suggests that sea microalgae can become an liquid waste processing agent is more effective than conventional methods and able

to become as a new alternative resource of raw material for biodiesel. The advantages of sea microalgae compared to the land plants of algae such as : first, oil content the microalgae sea quite high between 20-50%, even for this kind of *Nannochloropsis sp* can reached 68% of dry weight (Chisti, 2008). Second, growth rate very fast and does not require a large area (Asep 2010). Sea microalgae are able of producing oil in greater quantities than land plants.

Table 2.1 Ratio of Oil Content on various types of Microalga. (Chisti, 2007)

Types of microalga	Oil content (% dry weight)
<i>Botryococcus braunii</i>	25–75
<i>Chlorella sp.</i>	28–32
<i>Cryptocodinium cohnii</i>	20
<i>Cylindrotheca sp.</i>	16–37
<i>Dunaliella primolecta</i>	23
<i>Isochrysis sp.</i>	25–33
<i>Monallanthus salina</i>	>20
<i>Nannochloropsis sp.</i>	31–68

### 3. MATERIAL AND METHODE

The materials used in this research is tofu liquid waste are obtained from tofu home industry in Mrican village, inoculums of microalgae *Nannochloropsis sp* are obtained from BPAP Jepara and fertilizer NPK, Urea and TSP, NaHCO<sub>3</sub> technical grade. Tools are used include Buble Column reactor, aerator, neon lights, spektrofotometer Sp Optima 300, extraction tool gerhard and glassware.

Research begins with the preparation of materials of tofu liquid waste. Waste is filtered to reduce the total solid and then without sterilization, directly mixed with seawater according variable percent volume (0%; 20%; 40%; 60%) with added nutrition 30 ppm. Microalgae *Nannochloropsis sp* 10% V with OD 0.5 added to Buble Column reactor containing media with lighting and aeration for 24 hours.

Measurement of the optical density is done every day by the spektrofotometry method using a spectrophotometer Sp Optima 300 at a wavelength 680 nm. Where the analysis the decrease organic COD levels are conducted at the beginning and end of the period cultivation with permanganometry methods.

### 4. RESULT AND DISCUSSION

#### 4.1. Effect of Percent Volume of Tofu Liquid Waste to Optical Density

Based on Figure 4.1 shows that optical density values of all the variables tend to rise at the

beginning of cultivation, and then decline in the mid-and rise in later cultivation. Increase in Optical Density at the beginning of the cultivation is the effect of the process of homogenization between sea water and total suspended solids of liquid waste. Dilution of total suspended solids leads to increased concentrations of tofu liquid waste. So, the value of OD in media at the beginning for cultivation 1-4 days tend to rise. While the decline of OD in cultivation in the middle occur because chemical compounds of polymer components in the waste degradation into simple compounds. Tofu liquid waste containing polymer compounds of carbohydrate such as oligosaccharide, monosaccharide as well as containing other compounds such as proteins, amino acids, isoflavone, saponin, P, Ca, Fe and other nutrients (Barbosa et al., 2006).

Optical density is measurement of the level of turbidity or density of a solution, more concentrated a solution be values of optical density will be increased. Waste polymer compounds degradation proses resulted in reduced concentration. This concentration is a decline in profits that the component is ready to be used as nutrition for microalgae to grow. Therefore, after a phase of OD decline microlaga growth up. Growth up of a microalgae is characterized by an increased in the value of OD.

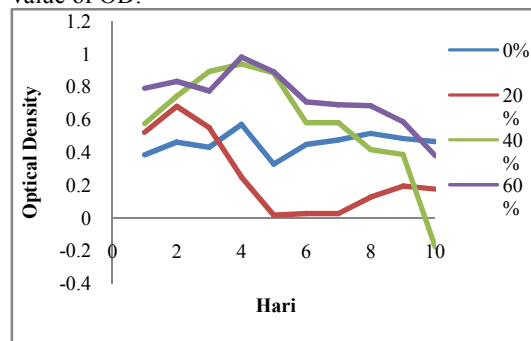


Figure 4.1. Relationship of Optical Density and %Volume Increase of waste Liquid Tofu

Level decomposition of Polymer compound on liquid waste largely determine the growth rate of microalgae. More faster the polymer breaks down, it will be faster growth rate of *Nannochloropsis sp* anyway. Based on the figure 4.1 fastest growth rates occurred at 20% volume percent. Variable more than 20%V, polymer compounds decomposition takes a longer time so that less effective for the purpose of processing waste and biomass production. An addition of liquid waste is greater than 20% V has a higher concentration of the polymer medium so that microalgae takes much

longer for decomposition, that result slowness of the process of growth and breeding.

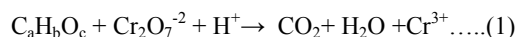
#### 4.2. Effect of Percent Volume of Tofu Liquid Waste to Chemical Oxygen Demand (COD)

Table 4.1. Effect of Percent Volume of Tofu Liquid Waste to Chemical Oxygen Demand (COD)after Processing by *Nannochloropsis sp*

No	Variable (%V)	COD (mg/L)		
		Initial	Finally	Decrease (%)
1	0	980.6452	960	2.11
2	20	4129.032	933.3333	77.40
3	40	4645.161	960.00	79.33
4	60	6193.548	1093.33	82.35

Treatment of tofu liquid waste using microalgae provide a fairly good results. This can be seen on table 4.1 that using microalgae type *Nannochloropsis sp* can be decreased of COD up to 82.35%. When compared with previous research by Hongyang dkk (2011), using microalga type *Nannochloropsis sp* has the capabilities in liquid waste better. Research Hongyang dkk (2011) show that soybean processing waste treatment using *Chlorella pyrenoidosa* is only able to decrease COD up to 77.8%

The best reduction of COD occurred in 60% variable where his descent up to 82.35%, while 20% variable is only able to decrease COD up to 77.40%. COD is amount O<sub>2</sub> mg required to oxidize the organic substances contained in 1 liter water sample using strong oxidizing as a source of oxygen.



COD is Indicate levels of organic number in a sample, higher value of COD then organic levels in a given sample are also higher. An organic components required as a nutrient for growth up a microalgae. 60% variable contains levels of organic greater than 20%V, therefore growth up of microalgae more optimal. This optimal conditions is indicate by the presence of a larger decline in COD.

#### 5. CONCLUSION

Percent volume of tofu liquid waste effect on optical density and a decrease in COD value. The larger of percent volume liquid waste will be the longer process decipherment of polymer compounds in effluent which resulted in the slowness of the process of growth of *Nannochloropsis Sp*. But, be increased in percent

volume of liquid waste cause greater decline in COD. In terms of growth, 20% V variable is the best, but if in terms of decreasing COD 60% V variable is the best.

Thus, the selection percent volume of liquid waste should be adapted to the purpose. if the purpose for production a biomass, percent volume 20% V more effectively. But for wastewater treatment, then 60% V variable is more effective.

#### ACKNOWLEDGMENTS

The writers thanks to the Rector of Diponegoro University that gave the Grants Research Students by 2013.

#### References

- Asep, Bayu. 2010. *Biodiesel dari Microalga laut : Potensi dan Tantangan*. Jurnal oseana. Vol. XXXV : 155-24. ISSN 0216-1877.
- Barbosa, Lopes A.C., Lajolo, F.M., Genovese, M.I., 2006. Influence of temperature, pH and ionic strength on the production of isoflavone-rich soy protein isolates. Food Chem. 98, 757–766.
- Bhatnagar, A., Bhatnagar, M., Chinnasamy, S., Das, K., 2010. Chlorella minutissima— a promising fuel alga for cultivation in municipal wastewaters. Appl. Biochem. Biotechnol. 161, 523–536.
- Chisti, Y., 2007. Biodiesel from microalgae. Biotechnol. Adv. 25, 294–306.
- Hambali, E., A. Suryani, Dadang, Hariyadi, H. Hannafi, IK. Reksowardojo, P. Suryadarma, S. Tjitrosemito, T. soerawidjaja, T. Prawitasari, T. Prakoso dan W. Purnama. 2006. Jarak Pagar Tanaman Penghasil Biodiesel. Penebar Swadaya, Jakarta:46-72.
- Edhy, W.A., Januar, dan Kurniawan. 2003. Plankton di Lingkungan PT. Central Pertiwi Bahari. Laboratorium Central Department, Aquaculture Division PT. Central Pertwi Bahari. Tulang Bawang. Haryoto dan Wibowo. 2004. Kinetika Bioakumulasi Logam Berat Kadmium.
- Fachrullah, Muhammad Rezza. 2011. Laju Pertumbuhan Mikroalga Penghasil Biofuel Jenis Chlorella Sp. Dan Nannochloropsis Sp. Yang Dikultivasi Menggunakan Air Limbah Hasil Penambangan Timah Di Pulau Bangka. Bogor.
- Hambali, E., S. Mujalipah, A.H.Tambunan, A.W. dan R. Hendroko. 2008. Teknologi Bioenergi. Agromedia Pustaka, Jakarta: 1-37
- Hongyang, su., Zhang Yalei., Zhang Chunmin., Zhou Xuefei., Li Jinpeng., 2011., Cultivation of Chlorella pyrenoidosa in soybean

- processing wastewater. *Bioresource Technology.*, 102, 9884–9890.
- Hu, Hanhua dan Kunshan Gao. 2006. Response of growth and fatty acid compositions of *Nannochloropsis* sp. to environmental factors under elevated CO<sub>2</sub> concentration. *Biotechnol Lett.China.* 28:987–992.
- Kawaroe, M. 2008. Mikroalga sebagai Bahan Baku Biofuel. *Surfactant and Bioenergy Research Centre, Lembaga Pengabdian Pada Masyarakat, Institut Pertanian Bogor. Bogor.*
- Kurniawan, Deni. 2010. Fungsi Unsur Hara Makro (N-P-K). <http://old.denidi.com/2007/11/fungsi-hara-makro-n-p-k.html>. Diakses pada tanggal 24 September 2012.
- Li, Y., Horsman, M., Wu, N., Lan, C.Q., Dubois-Calero, N., 2008b. Biofuels from microalgae. *Biotechnol. Progr.* 24, 815–820.
- Martínez, M.E., Sánchez, S., Jiménez, J.M., El Yousfi, F., Muñoz, L., 2000. Nitrogen and phosphorus removal from urban wastewater by the microalga *Scenedesmus obliquus*. *Bioresour. Technol.* 73, 263–272.
- Metcalf, E., Eddy, H., 2003. *Wastewater Engineering: Treatment and Reuse*. McGraw Hill, New York.
- Myrasandri, putri dan Mindriany Syafila., *Degradasi Senyawa Organik Limbah Cair Tahu Dalam Anaerobic Baffled Reactor*. Bandung. Program Studi Teknik Lingkungan, Fakultas Teknik Sipil dan Lingkungan, Institut Teknologi Bandung.
- Nurhasan dan pramudyanto, B.B.,1991, *Penanganan Air Limbah Tahu*, yayasan Bina Karya, Jakarta Selatan, <http://www.menlh.go.id> (24 september 2008)
- Perez-Garcia, O., Escalante, F.M.E., de-Bashan, L.E., Bashan, Y., 2011. Heterotrophic cultures of microalgae: metabolism and potential products. *Water Res.* 45, 11–36.
- Pranoto, Mei. 2005. *Penggunaan Biofilter Enceng Gondok (Eichhornia crassipes (mart)solm) untuk Menurunkan Kadar COD Limbah Cair dari Pabrik Tahu*. Skripsi. Semarang: UNNES
- Purwohadiyanto, Ir., Ir. Prapti Sunarmi, dan Ir. Sri Andayani, MS. 2006. *Pemupukan dan Kesuburan Perairan Budidaya*. Malang: Universitas Brawijaya.
- Santoso, Arif Dwi., Rahmania A. Darmawan, dan Joko P. Susanto. 2011. Mikro Alga Untuk Penyerapan Emisi Co<sub>2</sub> Dan Pengolahan Limbah Cair Di Lokasi Industri. *Jurnal Ilmu dan Teknologi Kelautan Tropis*, Vol. 3, No. 2, Hal. 62-70.
- Tang, C.-H., Ma, C.-Y., 2009. Effect of high pressure treatment on aggregation and structural properties of soy protein isolate. *LWT – Food Sci. Technol.* 42, 606–611.
- Wahyuni, K.A., Anindiatuti, Sapta Anjar L.M dan Agus H. 2001. *Teknik Penyimpanan Dan Kegunaan Nata De Nanno (Makalah Disampaikan Pada Pertemuan Lintas UPT Direktorat Jenderal Perikanan Budidaya, Yogyakarta 11014 September 2001)*. Lampung.
- Yang, C.F., Ding, Z.Y., Zhang, K.C., 2008. Growth of *Chlorella pyrenoidosa* in wastewater from cassava ethanol fermentation. *World J. Microbiol. Biotechnol.* 24, 2919–2925.
- Yu, H.Q., Hu, Z.H., Hong, T.Q., Gu, G.W., 2002. Performance of an anaerobic filter treating soybean processing wastewater with and without effluent recycle. *Process Biochem.* 38, 507–513.

## IMPROVING THE QUALITY OF BRIQUETTE FROM UTILIZATION OF SOLID WASTE OF FURFURAL SYNTHESIS PROCESS AS AN EFFORTS IN PROVIDING ALTERNATIVE ENERGY RESOURCES

Mitarlis and Tukiran

Department of Chemistry, Faculty of Mathematics and Natural Sciences  
State University of Surabaya  
mitarlis@gmail.com

### Abstract

*It had been done utilization of solid waste from furfural synthesis process into briquette, but the quality is not maximized. In this research, quality improvement make briquettes with addition of solid waste of furfural synthesis process and blotong was also potentially as briquettes. The method of research was done by making briquettes of each of the solid waste of furfural synthesis process and briquetting filter cake, then made briquettes from mixture of waste and filter cake. Briquette quality test conducted by the determination of water content, ash content and caloric value. The results showed that the briquettes from waste solid synthesis furfural process water content on lowest levels reached at 3:10 composition adhesive sample is 7.72% and meet SNI standard, 16.536% ash content almost meet SNI standard, as well as the caloric value of 2157 Kcal/Kg still not meet the SNI standard. Briquettes of blotong the water content is achieved at the lowest composition adhesive sample at 5:10 is 4.93% and meets the SNI standard, 37.74% ash content not meet SNI standard, as well as the caloric value of 2524 Kcal/Kg not meet SNI standard. Improving the quality of briquettes with mixing of solid waste of furfural synthesis processes and blotong on multiple comparisons and adhesive sample, achieved the best results with the highest caloric value of the waste and filter cake composition 10:40 and 7:10 of adhesive sample composition achieved calorific value 3242.57 though not meet SNI standard yet.*

**Keywords:** *briquettes, solid waste, furfural, blotong*

### BACKGROUND

The need for energy is increasing while the availability of energy resources dwindling. Various attempts have been made to the energy saving program or development of alternative energy using. In the provision alternated energy some researches have been carried out, among others, the

use of waste from abundant natural resources such as biomass. Various types of agricultural wastes such as bagasse, particle wood waste, pineapple leaves, lamtoro bark, corn cobs, and so has the potential to be used as a source of alternative energy. Similarly, the waste industry which rich biomass content such as filter cake (blotong) which is a sugar industry waste as a potential source of alternative energy.

The new technology is needed to diversify the utilization of waste materials mentioned above into high value products and more useful. One type is the use of alternative fuel convert blotong into briquettes. Blotong is a sugar factory waste that is not utilized earlier and more considered as junk. Based on initial testing, showed that heat energy yield from blotong briquette very low and burn out quickly. A research effort to improve the weaknesses of the blotong briquettes through by mixing with coal dust have carried out. The composition of the mixture were tested, among others, 90:10, 80:20, 70:30, 60:40 and 50:50 as the comparison blotong with powdered coal. Once tested and analyzed through the combustion process based data processing temperature, the mixture obtained blotong briquettes and coal powder is best to have a composition that is 60:40 [1].

While it has been done the research on the utilization of biomass into furfural. Research on furfural plant design has been done, the design is also a section for side product separating. In the process of furfural synthesis process produce side products such as glucose, acetic acid, and the rest of the pentose are not vaporized [2]. Utilization of biomass in addition to alternative fuels can also be used as starting materials in the manufacture of chemical raw materials such as furfural that Indonesia is still imported.

Research on the development of methods of synthesis of furfural also been done. Among others the development of furfural synthesis methods based on agricultural waste mixture in order to achieve the principles of green chemistry. The

results showed that the synthesis method developed furfural yield is only 5.58% of the weight of raw material. This method still gives containing byproduct material components early enough to be one factor that does not meet the principles of green chemistry [3]. The process of synthesis of furfural in the study still produces solid waste colored black carbon-rich, so it still has the potential to waste utilization as an alternative fuel such as briquettes. In this research, quality improvement of briquettes from solid waste furfural synthesis process by adding blotong which has the potential to be used as briquettes. Issues to be addressed is how the quality of the briquettes from solid waste of furfural synthesis process, briquette blotong, and how to improve the quality of solid waste of furfural synthesis process briquettes, with the addition of blotong and how the quality of the briquettes.

## METHOD

Method used in this study is an experiment in a laboratory scale. Make blotong with the general procedure of briquettes making with some variable of adhesive sample composition. Furthermore, also performed making briquette from solid waste of furfural synthesis process with some composition of adhesive samples. The procedure was done without going through the carbonation process because the characteristics of blotong had a black solid wastes such as soils containing a high enough of carbon 26.51% and the ratio C/N 25.62% [4]. In addition, the procedure to reduce the process and save energy. For the manufacture of briquettes compacted and dried blotong. The advantage of using briquettes blotong is the price that is cheaper than firewood and other fuels. However, it is necessary to make briquettes quite a long time between 4 to 7 days of drying, but it also depends on the weather conditions [5]. Similarly for briquettes from solid waste of furfural synthesis process, it make without through carbonation process because the characteristics of the waste has been a solid blackish -rich carbon content. Another variable is the manufacture of briquettes with some mixture composition of solid waste of furfural synthesis process and blotong, composition of adesive samples. The briquettes are then tested qualities include moisture content, and ash content, as well as caloric value.

## RESULTS AND DISCUSSION

In the process of making briquettes are several stages. The stages are drying solid waste of furfural synthesis process, mixing solid waste with adhesive, shaping, and drying briquette.

### 1. Drying Solid Waste of furfural synthesis processes

Solid waste furfural synthesis processes that have been separated from liquid waste is then dried in the sun for 5daysto obtain asolid wastethatis dry and ready to be processed into briquettes.



Figure1. Drying process of solid waste of furfural synthesis process by heating 4 hoursunder the sun

### 2. Mixing of Solid Waste with Adhesive

Dried solid waste of furfural synthesis process is mixed with adhesive in accordance with composition variables.

### 3. Shaping and Drying Briquette

Briquettes shaping is done by using a pressing machine that is made of modified pipes and hydraulic press. Dough mixture of solid waste furfural synthesis and adhesive results are pressed in order to obtain briquettes with a tube shape and then dried in the sun.



Figure 2. Briquettes of solid waste synthesis process furfural

The briquettes were obtained and analyzed quantitatively to identify which test the moisture content, ash content test, and test the heating value. As a comparison test done as well quality of briquettes blotong without mixture, the quality is less than the maximum. These results will be compared with the quality briquette after mixing with solid waste of furfural synthesis process.

Blotong samples obtained were dried and the initial dry weight be determine. Blotong briquette manufacturing procedures as in the general manufacture of briquettes.

Similar to the manufacture ofbriquettesfromsolid waste of furfural synthesis process without through carbonation process because, duelargelybeen in the form of carbon.





Figure 3. Blotong briquettes

The results of water content test of briquettes in various variables as in Table 1.

Table 1. Water levels Briquettes from solid waste furfural synthesis process and blotong

Composition adhesive sample	Average water content (%)	
	Solid wasted furfural briquette	Blotong briquette
3 : 10	7,72	7,53
5 : 10	9,43	4,93
7 : 10	10,73	8.30

Comparison between the water content of briquette from solid waste furfural synthesis process and blotong briquettes diagrams presented in Figure 4.

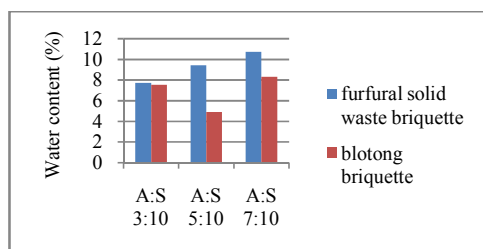


Figure 4. Diagram of water content briquettes comparison from solid waste of furfural synthesis and blotong

Based on Table 1 and Figure 4 water content of briquette from solid waste furfural synthesis processes that meet the standards of the briquette water content sample only the adhesive sample composition on 3:10, while briquettes blotong with adhesive sample ratio : 3:10 and 5:10 shave met the standard briquettes according SNI standard, and the blotong briquette by comparison 7:10 of adhesive sample was slightly higher, maximum water content of 8% (SNI 01-6235-2000). In general, the water content of the briquettes from solid waste furfural synthesis process higher than the water content of blotong briquettes. The higher the adhesive (tapioca) content also increases the water content of the briquettes produced. This is due to properties of tapioca can absorb water from the air [6]. Furthermore it was done the mixing of the solid waste furfural synthesis processes for improving the

quality of briquettes. Waste in the process of synthesis fufural taken at variable heating 4 hours. Data water content for briquetting mixture of solid waste and blotong on some waste composition ratio: blotong and adhesive samples as in Table 2.

Table 2. The water content of the briquette from solid waste of furfural synthesis process and blotong mixture on several compositions

Composition solid Waste and blotong	Composition adhesive sample	Average water content (%)
10:40	3:10	4.97
	7:10	4.47
20:30	3:10	7.13
	7:10	7.63
25:25	3:10	9.90
	7:10	9.43
30:20	3:10	11.17
	7:10	10.90

Based on Table 2 an increase in the quality of briquettes with decreasing of water content in solid waste blotong ratio 10:40 and 20:30. The higher composition of the solid waste the water content of the briquettes cause higher also. In addition beside water content also performed well for the determination of the ash content of the briquette from solid waste furfural synthesis process, blotong and mixing briquette of solid waste of furfural synthesis processes and blotong.

Table 3. The ash content of the solid waste briquettes and briquettes fufural blotong

Composition adhesive sample	Average ash content (%)	
	Solid wasted furfural briquette	Blotong briquette
3 : 10	16,536	37.75
5 : 10	22,637	37.74
7 : 10	23,384	38.06

Based on Table 3 ash content of the briquettes from solid waste of furfural synthesis process and blotong that no meets the standards of briquette ash content up to 15% according SNI (SNI 01-6235-2000). However, when compared blotong briquette ash content higher than the briquettes from solid waste furfural synthesis process as described in Figure 5.

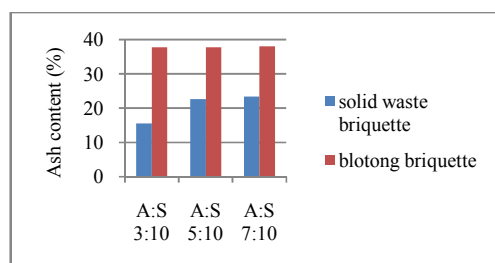


Figure 5. Diagram of comparison ash content of briquettes from the solid waste furfural synthesis process and blotong

Based on Figure 5 clearly seen ash content of blotong briquette is much higher than the ash content of the briquettes from solid waste furfural synthesis processes. High levels of ash content filter blotong briquette was caused of water content of blotong itself was relatively high at 9-20% [4].

Figure 4 and 5 seem obvious difference water content of briquettes from solid waste furfural synthesis process whereas higher while ash content briquettes blotong higher. Thus if done mixing expected to improve the quality of both. Ash content briquettes mixture of solid waste furfural synthesis processes and blotong included in the comparison of the lowest and highest adhesive samples are 3:10 and 7:10. Data ash content as in Table 4.

Table 4. Ash content of briquettes mixture from solid waste furfural synthesis process and blotong on multiple compositions

Composition Solid Waste and Blotong	Composition Adhesive Sample	Average Ash Content (%)
10:40	3:10	34.86
	7:10	35.43
20:30	3:10	30.00
	7:10	29.61
25:25	3:10	26.50
	7:10	25.05

The opposite of water content for the higher ash content of the waste composition in briquette mixture causes a decrease in ash content means improving the quality of briquettes. Lowest ash content achieved in the composition of the waste blotong briquettes 25:25 and 7:10 adhesive composition samples. It is very interesting to study further in the determination of briquettes quality and improvement efforts. Furthermore, the determination of caloric value. The caloric value is important for determining the quality of briquettes. Determination of caloric value of briquettes was

also carried out on the briquette from solid waste of furfural synthesis process and blotong briquette as well as mix briquettes. Data caloric value of briquette on many variables in Table 5.

Table 5. The calorific value of briquettes from furfural solid waste and blotong

Composition adhesive sample	Caloric Value (Kcal/Kg)	
	Solid waste furfural briquette	Blotong briquette
3 : 10	2157	2355
5 : 10	2171	2441
7 : 10	2291	2524

Table 6. Caloric value of briquette from mixture of solid waste furfural synthesis processes with heating time of 4 hours and blotong

Composition solid Waste and blotong	Composition adhesive sample	Average caloric value (%)
10:40	3:10	3161,44
20:30	3:10	2896,15
25:25	3:10	2825,55
30:20	3:10	2608,11
10:40	7:10	3242,57
20:30	7:10	2956,33
25:25	7:10	2771,05
30:20	7:10	2655,28

Based on Table 6 the highest caloric value of briquette mix with composition of solid waste : blotong at 10:40 with 7:10 sample adhesive composition is 3242.57 Kcal/Kg. From all variables briquette making in this study no one has met the minimum requirement according to SNI standard briquettes caloric value at least 5000 Kcal/Kg ( SNI 01-6235-2000 ), but admixture briquettes already increased in the quality of each parameter water content, ash content, and the caloric value than each briquettes from solid waste of furfural synthesis process or blotong.

## CONCLUSION

The results of this study showed that:

- The briquettes from waste solid synthesis furfural process water content on lowest levels reached at 3:10 composition adhesive sample is 7.72% and meet SNI standard, 16.536% ash content almost meet SNI standard, as well as the caloric value of 2157 Kcal/Kg still not meet the SNI standard.
- Briquettes of blotong water content is achieved at the lowest composition adhesive sample at 5:10 is 4.93% and meets the SNI standard, 37.74% ash content not meet SNI standard, as

well as the caloric value of 2524 Kcal/Kg not meet SNI standard.

- Improving the quality of briquettes with mixing of solid waste of furfural synthesis processes and blotong on multiple comparisons and adhesive sample, achieved the best results with the highest caloric value of the waste and filter cake composition 10:40 and 7:10 of adhesive sample composition achieved calorific value 3242.57 though not meet SNI standard yet.

#### ACKNOWLEDGEMENTS

We gratefully acknowledgement the Directorate General of Higher Education, Republic of Indonesia for providing research support through Hibah Penelitian Strategis Nasional 2013.

#### References

1. Hariyanto, Rudi, 2009. Analisis Peningkatan Kualitas Pembakaran Briket Blotong Berdasarkan Variasi Komposisi Bahan Briket. Jurnal Transmisi, Volume V, Edisi 2, September 2009. Journal from JIPTUNMERPP/2012-01-27 06:35:58. Malang: *Department of Mechanical Engineering* Merdeka University Malang. <http://digilib.unmer.ac.id/gdl.php?mod=browse&op=read&id=jiptunmerpp-gdl-rudihariya-5751&q=Batubara>
2. Wijanarko A, Witono J.A., Wiguna M.S., 2006. Tinjauan Komprehensif Perancangan Awal Pabrik Furfural Berbasis Ampas Tebu di Indonesia. *J.of Indonesian Oil and Gas Community*. Published by "Komunitas Migas Indonesia". <http://staff.ui.ac.id/user/1466/publications>
3. Mitarlis, Ismono, and Tukiran, 2011. Pengembangan Metode sintesis furfural berbahan dasar campuran limbah pertanian dalam rangka mewujudkan prinsip green chemistry. *J.Manusia dan Lingkungan*. Vo.18.No.3,Nov.2011:191-199. Yogyakarta: PSLH UGM
4. Kurwurj Risva, 2012. Blotong dan Pemanfaatannya. <http://www.risvank.com/2012/01/25/blotong-dan-pemanfaatannya/>
5. Safutra, Yofi 2012. Blotong Limbah yang bermanfaat. <http://ysafutra.blogspot.com/2012/12/blotong-limbah-yang-bermanfaat.html>
6. \_\_\_\_\_, 2012 Pengaruh Jenis dan Kadar Bahan perekat pada pembuatan briket. Bogor: IPB [http://repository.ipb.ac.id/bitstream/handle/123456789/52089/F11mra\\_BAB%20II%20Tinjauan%20Pustaka.pdf?sequence=6](http://repository.ipb.ac.id/bitstream/handle/123456789/52089/F11mra_BAB%20II%20Tinjauan%20Pustaka.pdf?sequence=6)

## FUZZY LOGIC AS THE CONTROLLER IN ELECTRONIC LOAD CONTROLLER SYSTEM

**M. Irfan, Machmud E., Nur Alif, M. Ilham P.**

Faculty of Engineering Department of Electrical Engineering  
Muhammadiyah University Malang

Jl. Raya Tlogomas No.246 Tlp. (0341) 464318 Malang 65144

e-mail :irfan\_tsd@yahoo.com, machmudeffendy@yahoo.com, nuralif@umm.ac.id,  
ilhampakaya@gmail.com

### **Abstract**

*Generally, PLTMH (Micro Hydro Power Plant) that uses ELC (Electronic Load Controller) which functions to control the voltage between consumers' load and dummy load, still detects only one parameter, either voltage or generator frequency. Meanwhile, in reality, whenever the consumers' load changes, the voltage and the generator frequency will also change.*

*When the consumers' load decreases, the electric current will be streamed to the dummy load as much as the decrease of consumers' load. During the shifting of the load, voltage and frequency distortion occurs; thus, there should be a special method to decrease the distortion by accelerating electrical load diversion using Fuzzy Logic algorithm.*

*To realize this system, a model of Fuzzy Logic Controller (FLC)-based digital Electronic Load Controller (ELC) device is designed. This model uses Matlab program for the simulation.*

*The result of generator model simulation showed that the generator is capable of producing electric power and the main load is able to absorb the power output from the generator, too. While the result of the simulation of electronic switch showed that TRIAC component is capable of channeling the electrical current to the dummy load suitable with the switching angle. If the switching angle is 25°, then 25% of the generator power will be supplied to the dummy load, and so will the other switching angles. The FLC-based output showed that total Power is the sum of power in the main load and the dummy load.*

**Keywords:** PLTMH, ELC, Fuzzy Logic, TRIAC

### **BACKGROUND**

PLTMH (Micro Hydro Power Plant) is one of renewable sources of energy that have not been utilized in Indonesia. Based on the data from ESDM Department, Indonesia has water power

potential of 75.000 MW and so far, only 13.9% of the potential that has been used. Therefore, the use of PLTMH in potential areas to build micro hydro power plant needs to be improved so that the needs of electric power does not only depend on PLN (State Electricity Company).

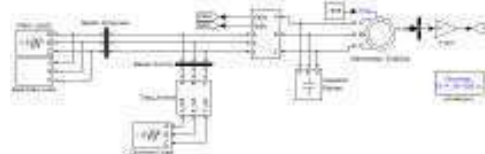
Some Micro Hydro Power Plants have used PLC. However, the PLC used only detects one parameter only, either voltage or generator frequency. Meanwhile, in reality, whenever there is a change in consumers' load, voltage and generator frequency also changes because there is over speed in the generator.

One of the characteristics of ELC is the existence of dummy load which functions as the stabilizer of electric load in the generator. When the consumers' load decreases, electrical current will be streamed to the dummy load as much as the decrease in the consumers' load. During the diversion of the load, voltage and frequency distortion takes place; hence, there should be a special method to decrease this distortion by accelerating the process of electric load diversion using Fuzzy Logic algorithm.

### **METHOD**

In order to make the model and simulate ELC, a software known as Matlab program is needed.

The following is FLS-based digital ELC model in Micro Hydro Power Plant.



Picture 1.FLC-based ELC Model

From picture 1, it is clear that to make and simulate ELC, there are several models needed, which are:

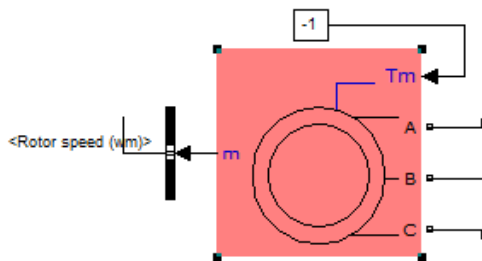
- Induction generator and excitation system model

- Main load and pseudo load model
- Electronic switch Model
- FLC design model

### Induction Generator and Excitation System Model

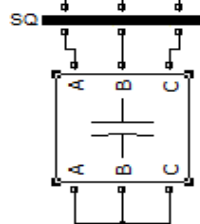
The generator used in this research is 3-phase induction generator with the following parameters:

Rated power, voltage (V or line), and frequency [P (W), V (V), f (Hz)]	[4000 400 50]
Stator resistance and inductance [R (Ω), L (mH)]	[0.0012 0.00006]
Rotor resistance and inductance [R (Ω), L (mH)]	[0.00001 0.000001]
Mutual inductance (mH)	[0.0001]
Pole pairs	[2]
Slip constant, friction factor, pole pairs [K (1/s), B (1/s), P (Hz)]	[0.0001 0.0001 2]
Initial conditions	[0.000000000 0.000000000 0.000000000 0.000000000 0.000000000 0.000000000]
Simulation parameters (T (s), dt (s), N (Hz))	[10 0.0001 5000]



Picture 2. Induction Generator Model

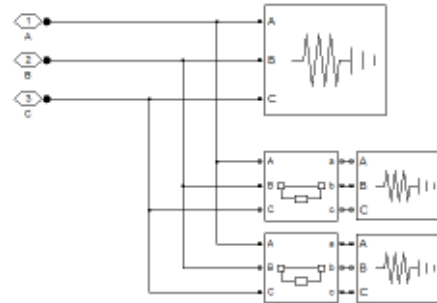
In order to generate voltage in induction generator, it requires reactive power supply in the generator, or this reactive power supply is provided in the form of 100-microfarad capacitor component. The following is the picture of excitation system model in the form of capacitor component.



Picture 3. Excitation System Model

### Main Load and Dummy Load Model

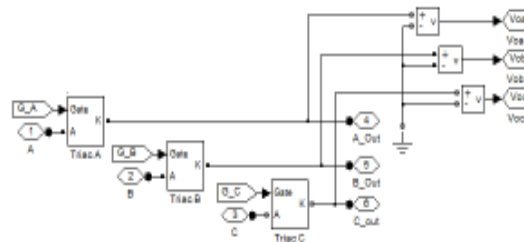
The main load and dummy load used in this research is resistif.



Picture 4. Main Load and Dummy Load Model

### Electronic Switch Model

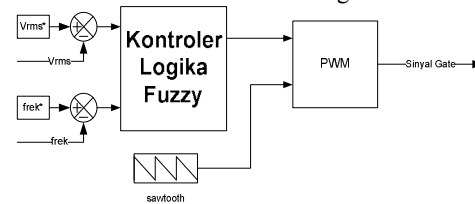
Electronic switch used is a thyristor which is connected in anti-parallel way to form a triac as being shown in the following Picture 5.



Picture 5. Electronic Switch Model

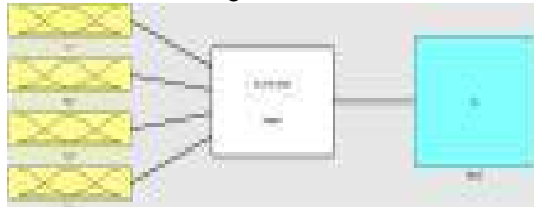
### FLC algorithm Model

In order to control FLC-based ELC system, the model is shown in the following Picture 6:



Picture 6. ELCFuzzy Control System Model

Fuzzy membership design configuration in ELC is in the following Picture 7:

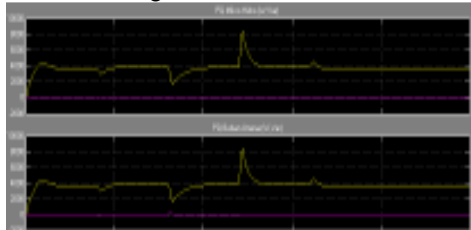


Picture 7. Fuzzy Membership Design in ELC

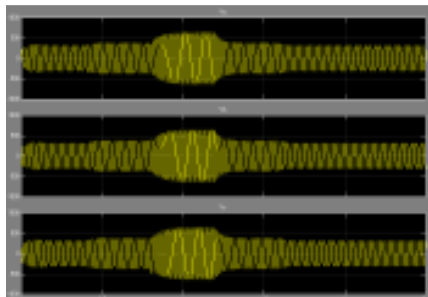
## RESULT AND DISCUSSION

From the system planning described above, the results of the planned system model test are presented in the following:

- The result of generator and load model test

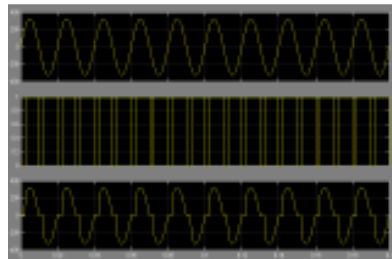


Picture 8. Active Power in Generator and Main Load

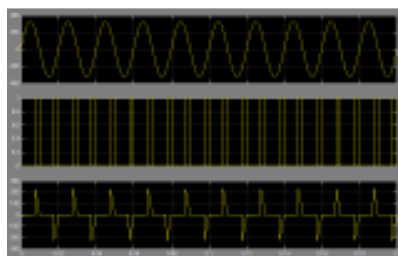


Picture 9. Voltage in Generator and Main Load

- The result of electronic switch test



Picture10. TRIAC Switching Angle 25°



Picture11. TRIAC Switching Angle 75°

- The results of fuzzy logic control test

Table 1. Fuzzy Logic Output Test

Power Load (W)	Error Freq. (Hz)	Error Voltage RMS Phase A (Volt)	Duty Value C.	Dummy Load (W)
3500	0	0.3	-	-
3250	0.54	-8.32	0.66	250.5
3000	1.09	-15.09	0.58	495.5
2750	1.58	-22.97	0.52	751.5
2500	2.04	-42.30	0.48	1002
2250	2.49	-46.73	0.43	1250
2000	2.88	-73.14	0.38	1496
1750	3.17	-77.16	0.34	1752
1500	3.52	-97.59	0.28	1999
1250	3.95	-150.90	0.22	2250
1000	4.25	-168.10	0.001	2499

## CONCLUSION

Based on the research above, it can be concluded that:

1. Generator model, excitation model, main load and dummy load model, and electronic switch model are the support of FLC-based ELC model,
2. The result of generator model simulation showed that the generator is capable of producing electric power as much as 4000 W and the main load can absorb the electric output from the generator with voltage per phase as much as 220 V.
3. The result of electric switch simulation showed that TRIAC as the main component is able to channel electrical current to the pseudo load suitable with its switching angle. If the switching angle is 25°, then 25% of the generator power will be streamed to the dummy load, and so are the other switching angles.
4. The total results of FLC-based ELC model showed that total power if the sum of power in the main load and the dummy load.

## References

- Akhmad Hasan, 2006, "Pengontrol Beban Elektronik Pada Pembangkit Listrik Tenaga Mikrohidro", Jurnal Ketenagalistrikan, BPPT.
- Dafid, 1999, "Solid State Pulse Circuit", Prentice Hall
- DPPM, 2012, "Rencana Induk Penelitian 2012 – 2016", Universitas Muhammadiyah Malang, Malang.
- ESDM, 2006, "Kebijakan Pengembangan Energi Terbarukan Dan Konservasi Energi (Energi Hijau)", Departemen ESDM.

- IMIDAP, 2008, “*Standarisasi Peralatan Mekanis dan Elektronik PLTMh*”, Integrated Microhydro Development Application Program.
- Irfan, 2009, “Studi Kelayakan Potensi Pembangkit Listrik Tenaga Mikro Hidro di Desa Karangsuko Kec. Pagelaran Kab. Malang” UMM.
- Irfan, 2012, “Penerapan Teknologi Kontrol Beban Elektronik Pada Pembangkit Listrik Tenaga Mikro Hidro di Desa Karangsuko Kec. Pagelaran Kab. Malang”, UMM.
- Handy Wicaksono, 2001, “*Kontrol PID Untuk Pengaturan Kecepatan Motor DC Dengan Metode Tuning Direct System*”, Jurnal Teknik Elektro Universitas Petra, Vol-4 No-1.
- Jan Portegijs, 2000, “*The Humming Bird, Electronic Load Controller and Induction Load Controller*”, Dutch Energy Distribution Company.
- Kusumadewi, Sri. 2003. “*Artificial Intelligence*”. Graha Ilmu Yogyakarta.
- Layman, 2000, “*Guide Book on How to Develop a Small Hydro Site*”, European Hydropower Association.
- Machmud, 2008, “*Desain Kontrol Beban Elektronik Pada PLTMh*”, Penelitian Pengembangan Ilmu UMM.
- Machmud, 2010, “*Desain Alat Kontrol Beban Elektronik Digital Pada PLTMh*”, Penelitian Berorientasi Produk UMM.
- Nigim, 2005, “*Voltage Controlled Stand-Alone Microhydro Induction Generator System*”, International Journal of Global Energy Issues, Vol-24, pp-100-111.
- Ogata, Katsuhiko, 2000, “*Teknik Kontrol Automatik Jilid I*”, diterjemahkan oleh Edi Leksono, Erlangga-Jakarta, 1994.



## AUDIT DATA PROCESSING TOOL TO SUPPORT ENERGY CONSERVATION

**Galuh Prawestri Citra Handani, Rini Nur Hasanah, and Hadi Suyono**

Electrical Engineering Department, Brawijaya University

Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Email: ze\_ga\_pch@yahoo.co.id, rini.hasanah@ub.ac.id, hadis@ub.ac.id

### **Abstract**

*Energy plays an important role in achieving good level of life quality, including the social, economic, and environmental condition being essential for sustainable development. It also becomes the support for a country's economic activity. The recent worldwide energy crisis affects many aspects of human life and is potential to hinder countries development. Consequently, some energy saving and conservation measures are greatly needed. Energy conservation measures can be taken by doing an energy audit, for example in a building. It aims to determine whether a building uses energy efficiently or wastefully, and tries to explore the possibility to improve the energy use efficiency. To facilitate the analysis of audit data, computing tools are necessary. It could lighten the manual work to do in processing the data by the auditors. It would also save time and cost needed in energy audit. This article describes one example on how to design and build such computing tool. This tool will help in calculating electrical load usage, intensity of energy consumption, and many other desired energy audit parameters, by implementing the required computing algorithms. The results of calculation will be useful to propose some recommendation on how to make some energy retrofit measures.*

**Keywords:** energy audit, intensity of energy consumption, computing tools

### **INTRODUCTION**

Energy is the most necessary substance to undergo and maintain the life of every human being. Energy also becomes one of the important indications of a country development level. More developed a country is, higher would be its energy consumption, especially electrical energy. Not all people are aware of the need to save and conserve energy, so that any idea of measures to take should always be disseminated as much as possible to reach as many as possible people, as all are responsible to the sustainability of development and life generation.

One of the efforts to save and conserve energy resources is by always using energy efficiently. Energy efficiency is defined as the ratio of energy output to energy input, which is always associated with some particular condition (season, time, desired results, etc.) (DeGunther, 2008).

Energy efficiency level of a building can be determined through the process of an energy audit. It will give the information about the use of electrical energy in a building.

Some innovation in processing energy audit data is required in order that identification process can be done more quickly and more economical. It can be in a form of calculation software. A good software must be maintainable (can be maintained), which means that some changes in environmental conditions can affect changes in the software, so that it requires a special handling; dependable (reliable), which means that the software must meet the needs of users; and useable (can be used), which means the use of software can be done in general and can be understood by other users (Sommerville, 2011).

This article describes one example on how to design and build a software which can be used to help in processing and analysing energy audit data of a building. The software facilitates to know whether the use of electric energy in a building meets the prevailing standards or not. It is hoped that the software would facilitate to result in certain recommendation. It can become the reference for and be proposed to the building manager/decision maker to make some energy retrofit measures. The use of software is also expected to enable the users to determine the potential waste of electrical energy more quickly, so that the required measures can be taken accordingly.

### **ENERGY AUDIT**

Energy conservation is a systematic and planned efforts to conserve resources and improve the efficiency of energy utilization. Energy audits can be simply defined as a process to evaluate a building or plant that uses energy, and identify



opportunities to reduce consumption (Thumann et al., 2008).

The energy audit can be classified into several methods, i.e.:

a. *Energy Survey or Walk Through Audit*

It is often called the mini-audit. Audits are done simply, without detailed calculations, just doing a simple analysis. Generally, the focus of this audit is in the maintenance as well as cost-saving measures which do not require a large investment. The auditor is normally not someone who is professional in the field of energy auditing.

b. *Preliminary Energy Audit*

The purpose of the preliminary energy audit is to measure the productivity and efficiency of energy use and to identify possible energy savings. Preliminary energy audit activities include building identification, analysis of actual conditions, calculating the energy consumption, calculating energy waste, and some recommendations.

c. *Detailed Energy Audit or Full Audit*

Detailed energy audit is undertaken by using measuring tools/monitors previously installed on the equipments to determine the energy consumption. This type of audit is usually done by a professional auditor within a specified period of time. The audit was preceded by analyzing the cost of energy audits, building identification, analysis of actual conditions, and calculating all energy consumption. It includes the energy consumption of primary energy, such as electricity and fuel, as well as secondary energy, such as water, telephone use, and others. In addition, the rest to be done are calculating the energy waste, energy conservation opportunity, as well as sorting out some suggestions to save energy along with an analysis of the impact of the recommendation.

### Energy Consumption Index

Energy Consumption Index (ECI) is used to determine the level of energy efficiency use of a building. It can be carried out by comparing the index of energy consumption in a building to that of a standard building, for example in Indonesia (BSN, 2000; 2001). ECI can be formulated as follows:

$$ECI = \frac{\text{Total energy consumption}}{\text{Area}} \dots\dots\dots (1)$$

Standard values for ECI of some commercial buildings are as following: for office buildings is 240kWh/m<sup>2</sup>/year, for shopping center is 330

kWh/m<sup>2</sup>/year, for hotels (apartments) is 300 kWh/m<sup>2</sup>/year, and for hospitals is 380 kWh/m<sup>2</sup>/year.

ECI standards based on ISO 03-6196-2000 concerning Energy Conservation for Building Air Management System are shown in Table I.

By referring to Table 1, when the calculation results are still in the considered limits range, the level of energy usage can be considered as fair. If it is outside the normal range, energy saving measures should be taken to improve the ECI.

Table 1. ECI standard for AC  
at the recommended building

	Non AC room		AC room
	kWh/m <sup>2</sup> /month		kWh/m <sup>2</sup> /month
Very efficient	4,17 – 7,92	Efficient	0,87 – 1,67
Efficient	7,93 – 12,08	Sufficiently efficient	1,67 – 2,50
Sufficiently efficient	12,08 – 14,58	Inefficient	2,50 – 3,34
Rather inefficient	14,58 – 19,17	Very inefficient	3,34 – 4,17
Inefficient	19,17 – 23,75		
Very inefficient	23,75 – 37,50		

### Computing Tool for Energy Audit Data Processing

A good computing tool should fulfill the function and performance required by the user, as well as be maintainable, reliable, and usable. Furthermore, its development should be able to be carried out efficiently by adding more appropriate techniques for different types of building systems.

The resulted tool shown in this article has been built using Visual Basic 6.0 programming language being developed by Microsoft since 1991. Visual Basic is a programming language that can be easily learned, used and of quick property in making Windows-based visual applications. Visual Basic runs in 3 modes:

- Mode *Design*, which is used to design the application
- Mode *Run*, which is used to run the application
- Mode *Break*, which could be used to break momentarily while activating Visual Basic Debugger being used to debug the program, especially when tracing an error is desired.

The concept of Visual Basic application development begins with the creation of *user interface*, which is used to display some forms for entering input data as well as to show the output/calculating results. It is built using a series of instructions/programming codes (*scripts*) for

each object components. The interface of Visual Basic 6.0 contains menus, toolbar, toolbox, form, project explorer and properties, as shown in figure 1 (Basuki, 2006; Wahyono, 2010).

The next step to do is setting-up properties of the object to use, and finally writing the sequence of instructions or program of each object.

## TOOL DESIGN AND IMPLEMENTATION METHODOOGY

The method used to design and build the audit data processing tool is shown in the flow-chart of figure 2.

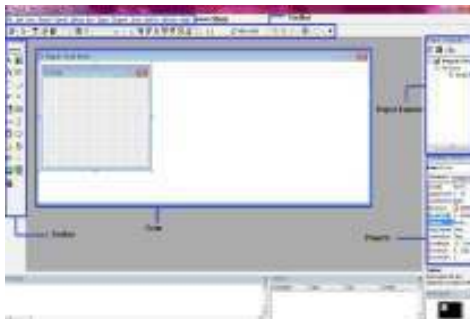


Fig. 1. Screen display of Microsoft Visual Basic 6.0

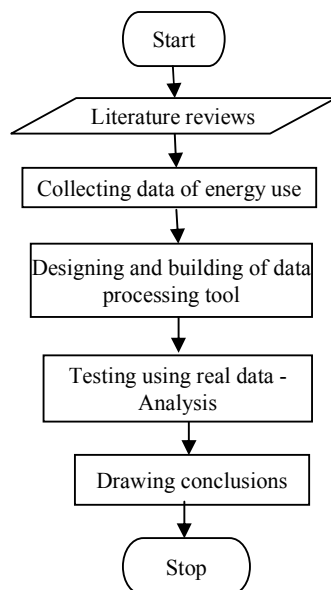


Fig. 2. Flow-chart of the design and building of the energy audit data processing tool

Flow-chart of the use of tool to analyze energy audit data can be seen in Fig. 3.

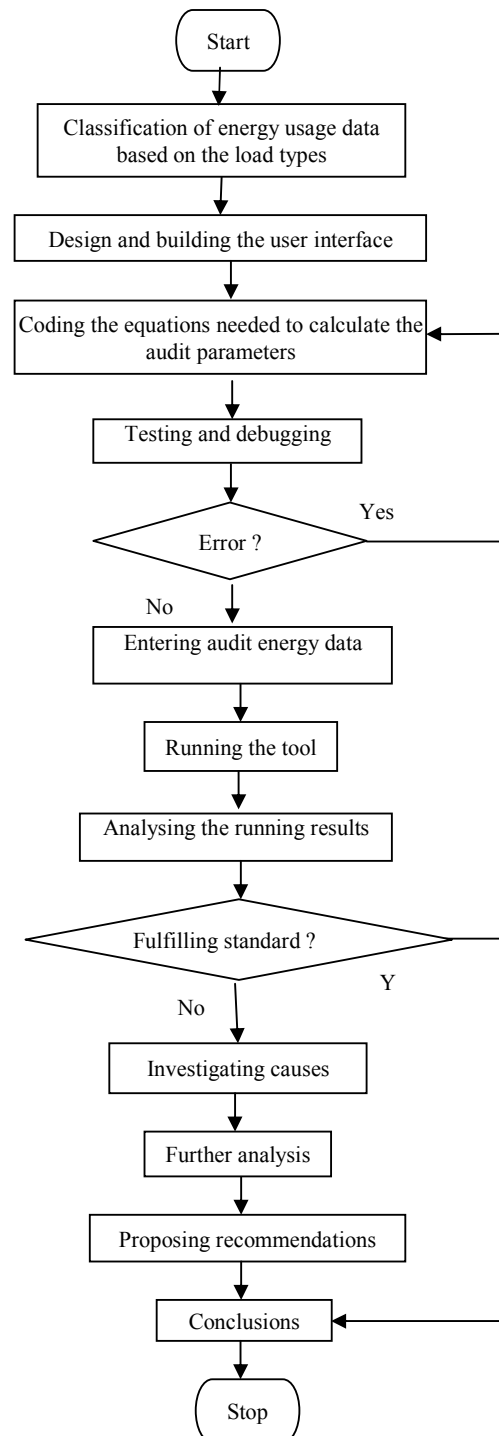


Fig. 3. Flow-chart of the tool use to analyze energy audit data

## RESULTS AND DISCUSSION

The first thing to know before building the audit data processing tool is the load usage data and the derived energy audit parameters to determine. In this article, it is desired to determine the total electrical load calculations, total energy

consumption, index of energy consumption and monthly cost of electricity to pay. After knowing the required data and the procedures to calculate the audit parameters, the computing tool design process can be performed. The required equations for designing the tool are described as following.

### 1. AC loading in a room:

$$\text{Total AC loading [in watt]} = \text{number of installed AC} \times \text{AC capacity} \dots\dots\dots (2)$$

$$\text{Total AC energy usage [in kilowatt-hour]} = \text{total AC loading} \times \text{time duration} / 1000 \dots\dots\dots (3)$$

### 2. Lighting load in a room:

$$\text{Total lighting load [in watt]} = \text{capacity of light bulbs} + \text{capacity of fluorescent lamps} + \text{capacity of halogen lamp} + \text{capacity of emergency lamps} + \text{capacity of other lamps in the room} \dots\dots\dots (4)$$

$$\text{Total lighting energy usage [in kilowatt-hour]} = \text{total lighting load} \times \text{time duration} / 1000 \dots\dots\dots (5)$$

### 3. Other installed loads in the room (computer, printer, refrigerator, TV, etc.):

$$\text{Total loading of other loads [in watt]} = \text{capacity of load 1} + \text{capacity of load 2} + \text{capacity of load 3} + \text{capacity of load 4} + \text{capacity of load 5} + \dots\dots\dots (6)$$

$$\text{Total energy usage of other loads [in kilowatt-hour]} = \text{total loading of other loads} \times \text{time duration} / 1000 \dots\dots\dots (7)$$

### 4. Total loading in a room:

$$\text{Total loading of a room [in watt]} = \text{total AC loading} + \text{total lighting load} + \text{total loading of other loads} \dots\dots\dots (8)$$

$$\text{Total energy usage of a room [in kilowatt-hour]} = \text{Total AC energy usage} + \text{Total lighting energy usage} + \text{Total energy usage of other loads, or} \dots\dots\dots (9)$$

$$\text{Total energy usage of a room [in kilowatt-hour]} = \text{Total loading of a room} \times \text{time duration} / 1000 \dots\dots (10)$$

### 5. Energy Consumption Index of a room:

$$\text{ECI non-AC room [in kWh/m}^2\text{/day]} = \frac{\text{total energy usage in a room} - \text{total AC energy usage}}{\text{total area}} \dots\dots (11)$$

$$\text{ECI non-AC room [in kWh/m}^2\text{/month]} = \frac{\text{ECI non-AC room} \left[ \frac{\text{kWh}}{\text{m}^2 \text{ day}} \right]}{30} \dots\dots\dots (12)$$

$$\text{ECI AC room [in kWh/m}^2\text{/day]} = \frac{\text{total energy usage in a room} - \text{total AC energy usage}}{\text{total area}} + \frac{\text{total AC energy}}{\text{total area of AC}} \dots\dots\dots (13)$$

$$\text{ECI AC room [in kWh/m}^2\text{/month]} = \frac{\text{ECI AC room} \left[ \frac{\text{kWh}}{\text{m}^2 \text{ day}} \right]}{30} \dots\dots\dots (14)$$

### 6. Total energy usage of all rooms:

$$\text{Total energy usage of all rooms [in kilowatt-hour]} = \text{Total AC energy usage of all rooms} + \text{Total lighting energy usage of all rooms} + \text{Total energy usage of other loads in all rooms} \dots\dots\dots (15)$$

### 7. Total energy usage per month:

$$\text{Total energy usage per month [in kWh/month]} = \text{total energy usage of all rooms} \times 30 \dots\dots\dots (16)$$

### 8. Total energy cost per month and ECI of the building:

$$\text{Monthly energy cost} = \text{Total energy usage per month} \times \text{base electricity tariff} \dots\dots\dots (17)$$

$$\text{Monthly ECI} = \text{Total energy usage per month} / \text{total area of the building} \dots\dots\dots (18)$$

The next step to do is designing the user interface being adapted to the required procedures to display. Furthermore, coding of the concerning equations can be done, as shown in figure 4 and 5.



Fig. 4. Code listing of program for *Form 1*

After the user interface and code listing have been built, the application software can be run. Figure 6 and 7 consecutively show the running results obtained using the code listing for *Form 1* and *Form 2* program.



Fig. 5. Code listing of program for *Form 2*



Fig. 6. Display of *Form 1*: Building profile and energy usage



Fig. 7. Display of *Form 2*: Calculation of energy usage

After energy usage data have been filled in the form, the resulted displays are shown in figure 8 and 9.

The resulted tool has been implemented to analyze the energy audit data of a sample building which has a total floor area of 2160 m<sup>2</sup>. The total energy use of air conditioning load is 645.2867 kWh, the total consumption of lighting load is 182.844 kWh, whereas the total energy consumption of other loads is 888.18 kWh. The total energy consumption of the loads in all rooms becomes 1716.3107 kWh. The monthly energy usage is 51489.321 kWh, whereas the bill to pay based on the *TDL* (Base Electricity Tariff) of the national electrical company PLN (IDR 1380) becomes USD 71,055,262. ECI of the building per month is 23.838 kWh/m<sup>2</sup>, while the annual ECI of the building is of 286.052 kWh/m<sup>2</sup>.



Fig. 8. Display of *Form 1* after data entering

Fig. 9. Display of Form 2 after data entering and calculating process

From the results of calculation, it is also known that the largest energy consumption has been obtained from other loads such as television, refrigerator, computers, printers, photocopy machines, dispensers, etc., with the total percentage of energy consumption of 51.749%.

Being compared to standards, it is known that the index of energy consumption of the sample building exceeds the standard. The calculation result of annual ECI is 286.052kWh/m<sup>2</sup> being compared to the standards for office buildings established based on the research results of ASEAN-USAID, i.e. 240 kWh/m<sup>2</sup>. This condition puts the building into category of wasteful energy consumption. This wastage can be caused by excessive consumption of electrical appliances and the use of lights with low-level of efficiency.

Some recommendations given are to replace some loads with energy-efficient electrical loads. The choice and placement of air conditioner should be adapted to the room size as well as the furnitures configuration, for example. Turning-off the air conditioning when the room is not in use, closing the window when the air conditioner is on, and setting the temperature at about 25°C are some tips that can also be suggested. For lighting loads, incandescent and fluorescent lamp can be replaced using energy-saving lamps. Other loads such as computers, printers, etc. should only be turned on and used as needed.

## CONCLUSIONS

From the design, implementation, and results analyses, it can be concluded that:

- Processing energy audit data is far easier with the help of a computing tool.
- A computing tool in a form of an energy audit software can be designed and built based on the

parameters to determine and the corresponding required audit data.

- Recommendations to improve the energy efficiency can be proposed to the energy manager/decision maker based on the implementation results of the software on the available energy audit data.

## References

- Badan Standarisasi Nasional. *SNI 03 – 2396 – 2001 tentang Tata Cara Perancangan Sistem Pencahayaan Alami pada Bangunan Gedung*. Jakarta : BSN, 2001.
- Badan Standarisasi Nasional. *SNI 03 – 6196 – 2000 tentang Konservasi Energi Sistem Tata Udara pada Bangunan Gedung*. Jakarta : BSN, 2000.
- Badan Standarisasi Nasional. *SNI 03 – 6197 – 2000 tentang Konservasi Energi Pada Sistem Pencahayaan*. Jakarta : BSN, 2000.
- Badan Standarisasi Nasional. *SNI 03 – 6390 – 2000 tentang Konservasi Energi Sistem Tata Udara pada Bangunan Gedung*. Jakarta : BSN, 2000.
- Basuki, Achmad. *Algoritma Pemrograman 2 Menggunakan Visual Basic 6.0*. Surabaya : PENS ITS Surabaya, 2006.
- Bureau of Energy Efficiency (BEE), Ministry of Power, India. *Energy Efficiency in Electrical Utilities*. Book 3. 2004
- DeGunther, Rik. *Energy efficient homes for dummies*. Wiley. com, 2008.
- Kementerian Perindustrian. *Pedoman Teknis Audit Energi Dalam Implementasi Konservasi Energi dan Pengurangan Emisi CO<sub>2</sub> Di Sektor Industri (Fase 1)*. Jakarta: Pusat Pengkajian Industri Hijau dan Lingkungan Hidup Badan Pengkajian Kebijakan, Iklim, dan Mutu Industri (BPKIMI), 2011.
- Peraturan Menteri Energi dan Sumber Daya Mineral Republik Indonesia Nomor 14 Tahun 2012 Tentang Manajemen Energi*.
- Peraturan Pemerintah Republik Indonesia Nomor 70 Tahun 2009 Tentang Konservasi Energi*.
- Sommerville, Ian. *Software engineering*. Edition 9th. United States of America: Pearson Education, Inc., 2011.
- Thumann, Albert, and William J. Younger. *Handbook of energy audits*. The Fairmont Press, Inc., 2008.
- United Nation Environment Programme. *Pedoman Efisiensi Energi untuk Industri di Asia*. (www.energyefficiencyasia.org). 2006.
- Wahyono, Teguh. *Membuat Sendiri Aplikasi dengan Memanfaatkan Barcode*. Jakarta: PT Elex Media Komputindo, 2010.

## **FRACTIONAL DISTILLATION OF CLOVE OIL AT VACUUM PRESSURE**

**Widayat, Muhammad Hilman H, Lily Nurdiana, Hadiyanto, Ngadiwiyana<sup>\*)</sup>,  
Bambang Cahyono<sup>\*)</sup> dan Hantoro Satriadi**

**Jurusan Teknik Kimia, Fakultas Teknik, Universitas Diponegoro  
Jln. Prof. Sudharto, Tembalang, Semarang, 50239, Telp/Fax : (024) 7460058  
<sup>\*)</sup> Jurusan Kimia Fakultas Sains dan Matematika Universitas Diponegoro  
E-mail: yayat\_99@yahoo.com**

### **Abstract**

*Clove oil is one of Indonesian export commodity on essential oil sector. Now days the problem faced by purification agent is low content of eugenol in clove oil so clove oil price is low. The goal of this research is to know operation pressure influence in advancing eugenol of clove oil. This vacuum fractionation distillation process is using variation of vacuum pressure 0,8; 0,6; 0,4 and 0,2 bar. The result of this research show quantity of eugenol 99% can be reached from first fraction, 8m high packing and pressure 0,2 bar. Vacuum pressure is used to make boiling point of clove oil lower so can avoid cracking. Higher pressure, smaller feed flow rate so quantity of eugenol can be reached lower.*

**Keywords :** clove oil, vacuum distillation, eugenol

### **BACKGROUND**

Clove oil is essential oil from clove plant (*Eugenia caryophyllata* Thunb). Essential oil can be obtained from flower, stalk, leaf of clove plant. The oil quality is evaluated from phenol content, principally eugenol. (Bhuiyan et.al, 2010)

Clove oil which is obtained from clove plant until now have not succeed synthetic yet so cause high quality clove oil necessity higher (Widayat et.al, 2012). The goal of this research is to get optimum condition in clove oil eugenol purification. Clove oil composition can be seen at table 1.

Table 1. Clove oil composition (Jung et.al, 2005)

Component	Content (%)	Boiling point (°C) (1 atm)
Eugenol	38.3 -95.2	254
Caryophyllene	6.3 – 0.2	129
Other	55.4 – 4.6	-

Eugenol is the main component of clove oil that is no colour, has an specific aroma, spicy, usually used in fragrance industry and flavor because they have specific aroma and pharmacy

industry because they are antiseptic.  $\beta$ -Caryophyllene is impurity that have to be removed because reduce purity of clove oil (Ketaren,1998).

According standard of USP (United States Pharmacopeia) minimum eugenol content are 98% that allowed. Increasing eugenol content cause its cost increase too. Clove oil cost in Indonesia with eugenol content less 70% is Rp 120.000,00/kg and more 98% is Rp 500.000,00/kg. Nowadays clove oil product dominated of eugenol content 70%. Therefore need to be done a research to found out eugenol content minimum in clove oil 99%, so its value will higher.

There are two methods to obtain eugenol, first chemistry purification (extraction) and physic purification (vacuum fractionation distillation) (Sukarsono et.al, 2003).

#### **1. Extraction**

Extraction process use NaOH and produce eugenol content 82,6% (Anny, 2002). There was a experiment with extraction clove leaf oil use excess NaOH and acidic process with concentrated HCl its result was eugenol content just up to 89,65%. (Luthfi et.al, 2013)

The witness of extraction process are solvent recovery and low eugenol content that form. Fractionation distillation process that has been done obtain eugenol content 99% with eugenol content 93% as feed. That experiment result can not aplicated in UKM Batang.

#### **2. Vacuum Distillation**

Clove oil purification use fractionation distillation can increase eugenol content from 93% up to 97% (Nurhasanah et.al,2009). There is not process that result eugenol content 98%. Vacuum pressure cause boiling point of clove oil lower to avoid cracking.

This research is eugenol isolation with fractionation distillation in vacuum pressure without adding other materials like NaOH. The feed use clove oil with eugenol content 70% - 85%.

## METHOD

Clove oil used is clove oil from UKM Minyak Atsiri Kab. Batang, Central Java. Variables in this research are pressure variation those are 0,2; 0,4; 0,6; and 0,8 bar. Volume of feed is 200 ml, packing high 8 cm and 1 hour operation time.

Experiment was done in batch process where fraction column was designed from glass and fixed bed system. Vacuum system used vacuum pump showed in fig 1. Clove oil poured into distillation column and heated by heating mantle until clove oil boil away.

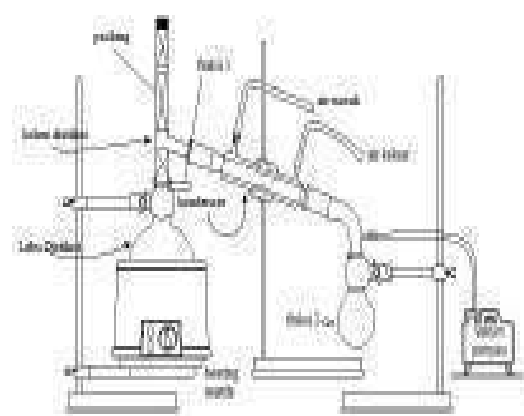


Figure 1. Design of fractional distillation at vacuum pressure

## RESULT AND DISCUSSION

Table 2. Temperature Operation

Pressure	Temperature (°C)		
	Residue	Fraksi 1	Fraksi 2
0,2	188	124	68
0,4	214	152	74
0,6	226	146	74
0,8	236	172	83

Table 3. Density of Distillate

Pressure	Density (gr/ml)		
	Residue	Fraksi 1	Fraksi 2
0,2	1.0500	1.0380	1.0170
0,4	1.1230	1.0440	1.0260
0,6	1.0700	1.0575	1.0170
0,8	1.0740	1.0410	1.0200

Table 4. Refractive index of Distillate

Pressure	Refractive Index		
	Residue	Fraksi 1	Fraksi 2
0,2	1.542059	1.54	1.531938
0,4		1.537036	1.533118
0,6		1.537986	1.532013
0,8		1.537539	1.53121

Table 5. Volume of Distillate

Pressure	Volume (ml)		
	Residue	Fraksi 1	Fraksi 2
0,2	59	52	86
0,4	53	63	81
0,6	34	98	65
0,8	68	83	46

### Effect of pressure on temperature operation

Boiling point is effected by pressure. Relationship between temperature and pressure is shown in Antoine's equation:

$$\log P = A - \frac{B}{C + T} \quad (1)$$

Where : P = pressure  
T = temperature

A,B,C = Antoine's constants

According Antoine's equation show if the pressure decrease, the temperature do too. High temperature effected cracking. Cracking is broken of carbon's chain with clove oil color become darker. Cracking can occur at 200 C (Van Ness et.al,1970). Fig 2 show at 200 C the pressure is 0,3 bar. To avoid cracking of clove oil, distillation is going on under 0,3 bar.

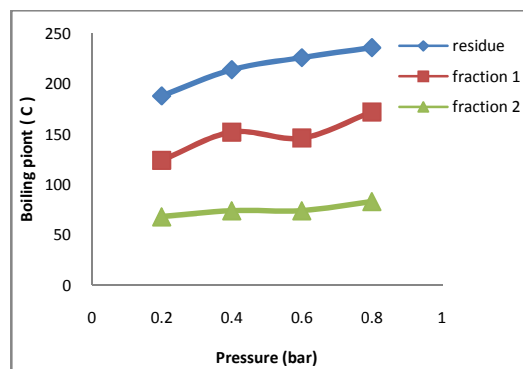


Figure 2. effect of pressure on boiling point





Figure 3. Clove oil cracking

#### Effect of pressure on density

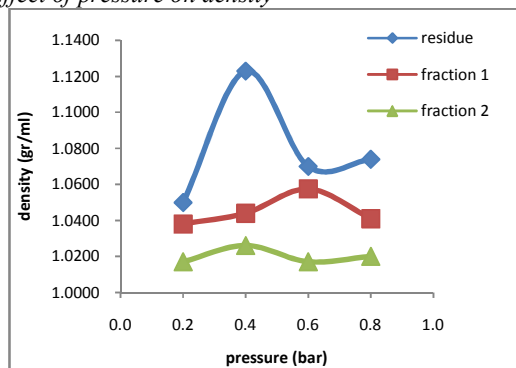


Figure 4. effect of pressure on density

Density is mass measurement every its volume. Density can be calculated by following equation

$$\rho = \frac{m}{v} \quad (2)$$

where :

$\rho$  = density (gr/ml)

$m$  = mass (gr)

$v$  = Volume (ml)

Density can be a parameter to find eugenol content in clove oil, density of eugenol is 1,049gr/ml. fig 4 show that density of fraction 1 approach eugenol's density. Eugenol must find in residue, but in this research density of residue is higher than eugenol's density because there is metal content in clove oil. According equation 2 when mass increase density do too.

#### Effect of pressure on refractive index

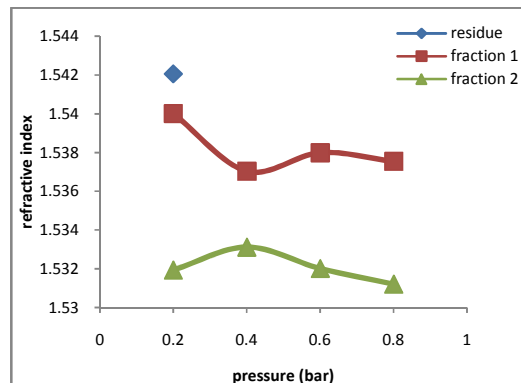


Figure 5. effect of pressure on refractive index

Refractive index is effected by liquid composition. In binary liquid refractive index can obtain its composition. Main component in clove oil are eugenol and caryophyllene. Assumption that clove oil is binary liquid and its contains are eugenol and caryophyllene. Eugenol content in distillate can be prediction by Lorentz-Lorenz (L-L) equation . Lorentz-Lorenz (L-L) equation is relationship between refractive index and composition in for binary liquid. By following equation

$$\frac{n_{12}^2 - 1}{n_{12}^2 + 2} = n_1 \frac{n_1^2 - 1}{n_1^2 + 2} + n_2 \frac{n_2^2 - 1}{n_2^2 + 2} \quad (3)$$

Where :

$n_{12}$  = refractive index of clove oil

$n_1$  = refractive index of eugenol

$n_2$  = refractive index of caryophyllene

$\Phi_1$  = volume fraction of eugenol

$\Phi_2$  = volume fraction of caryophyllene

(Mehra, 2003)

This research show that refraction index of fraction 1 and fraction 2. Refractive index of residue can not be analyzed by refractrometer because the metal contain in clove oil. According Lorentz-Lorenz (L-L) equation eugenol content in fraction 1 is 99,8% when 0,2 bar. To support Lorentz-Lorenz (L-L) equation, sample was analyzed by Gas Chromatography (GC) to obtain eugenol content. Eugenol content in fraction 1 when 0.2 bar is 99% was analyzed by GC.



### Effect of pressure in distillate volume

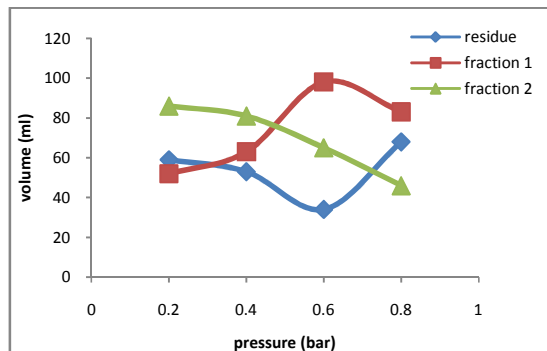


Figure 6. Effect of pressure in distillate volume

Fig 6 shows that volume of fraction 1 and residue increase when the pressure increase. Different phenomenon on volume of fraction 2, where the pressure increase its volume decrease because when the pressure decrease, the boiling point will decrease. The boiling decrease cause operation time faster. In operation time settled and pressure decrease, so volume of fraction 2 will increase.

### CONCLUSION

The result of this research show quantity of eugenol 99% can be reached from first fraction, 8m high packing and pressure 0,2 bar. if the pressure decrease, the temperature do too. High temeperature effected cracking.

### References

- Anny,Sri. 2002. *Pengolahan Lanjut Minyak Atsiri dan Penggunaannya Dalam Negeri*. Workshop Nasional Minyak Atsiri 30 Oktober 2002, Dirjen Industri Kecil Dagang Menengah, Depperindag
- Bhuiyan, Nazrul Islam, Jaripa Begum, Nemai Chandra Nandi dan Farhana Akter.2010.*Constituents of the essential oil from leaves and buds of clove (Syzigium*

*caryophyllatum (L.) Alston*).Bangladesh: African Journal of Plant Science Vol. 4

- Guenther E. 1987. *Minyak Atsiri*, jilid 1. Jakarta : Universitas Indonesia.
- Ketaren S. 1985. *Pengantar Teknologi Minyak Atsiri*. Jakarta : Balai Pustaka.
- Suhenry.
- Jung, Mi-jin, Yeon-Jae Shin, Se-Yeon Oh, Nam-Sun Kim, Kun Kim, Dong-Sun Lee. 2005.*Headspace Hanging Drop Liquid Phase Microextraction and Gas Chromatography-Mass Spectrometry for the Analysis of Flavors from Clove Buds*.Seoul: Department of Chemistry, Seoul Women's University.
- Ketaren. 1998. *Pengantar Teknologi Minyak dan Lemak Pangan*. Jakarta: UIPress.
- Luthfy, Machmud H, Wisnu Jati N and Aprilina Purbasari. 2013.*Peningkatan Kadar Eugenol Minyak Atsiri Cengkeh dengan Metode Saponifikasi-DistilasiVakum*. Semarang:Universitas Diponegoro
- Mehra Rita.2003. *Application of refractive index mixing rules in binary systems of hexadecane and heptadecane with n-alkanols at different temperatures*.India: Maharshi Dayanand Saraswati University.
- Nurhasanah, Siti ,Efri Mardawati, and Marleen Herudiyanto. 2009. *Pemisahan Eugenol dari Minyak Cengkeh dengan Cara Distilasi Fraksinasi*. Bandung : Universitas Padjajaran.
- Smith, J.M., H.C. Van Ness dan M.M. Abbott. 2005. *Introduction to Chemical Engineering Thermodynamics*. 7th Edition. McGraw- Hill Book Company. New York.
- Sukarsono, Imam Dahroni dan Dwi Heru Sucahyo. 2003. 'Kajian. "Pemisahan Komponen – komponen dari Minyak Cengkeh". Yogyakarta:Puslitbang Teknologi Maju BATAN.
- Widayat. Bambang Cahyono dan Ngadiwiyono. 2012. "Rancang Bangun dan Uji Alat Proses Peningkatan Minyak Cengkeh Pada Klaster Minyak Atsiri kabupaten Batang". Semarang : Teknik Kimia Undip. Jurnal Ilmu Lingkungan.

## GOVERNOR MODEL USING FUZZY - PID CONTROLLER FOR LOAD FREQUENCY CONTROL GENERATOR

Akhmad Ramadhani<sup>1)</sup> and Imam Robandi<sup>2)</sup>

Jurusan Teknik Elektro - FTI, Institut Teknologi Sepuluh Nopember Surabaya  
Kampus ITS, Keputih - Sukolilo, Surabaya 60111

### Abstract

*Load Frequency Control Generator is very important for stability and ability of power system quality. Frequency has made from primemover speed to rotating of generator, and then speed primemover has Controlled by Governor. This paper is researched about Governor model using hybrid Fuzzy-PID Control for Load Frequency Control. The result of simulation at SIMULINK MATLAB with parameter and Unit Step, Governor model using hybrid fuzzy PID Controller is better than Fixed droop Governor and PID Governor for Load Frequency Control*

**Keywords:** Governor, Fuzzy-PID Control, Load Frequency Control

### BACKGROUND

Power system generator will produce active power and reactive power. Active Power (Watt) is influence by the frequency generator, and then Reactive Power (Var) is influence by voltage generator. So that is very important component in quality of power system. The Change of load demand in the active power will changes of Frequency stability. Generator respon to change frequency depends on ability and stability used in this case the set frequency is Governor. The Governor will set the rotation speed of pramemover to remain stable according to its frequency. The convensional method that used Mechanical Fixed Governor is still used on the turbine generator. And then mechanical fixed droop governor developed into the PID Governor began to improve the performance of turbine generator for frequency setting. The PID Governor Controller can repaired load frequency performance, but it must be tuning proposional (Kp), Integral (Ki) and Integral (Kd) respectly for get the best respon governor for changes of load Generator. The Fuzzy Logic was first discovered by professor zadeh in 1965 and develoved into Fuzzy Logic Control (FLC) is

widely used in industrial application an technologies. For the flexibility posed by fuzzy logic membership function and rules can be optimized by other method (Hybrid Methode Fuzzy Rules) so in this paper used the Fuzzy PID Control is expected to futher improve the quality performance of Load Frequency Control Generator. The Result of simulation on SIMULINK MATAB with same Parameter and Unit Step, Governor model using Hybrid Fuzzy PID Controller is better than *Fixed droop Governor* and *PID Governor* For Load Frequency Control Generator.

### LOAD FREQUENCY CONTROL GENERATOR FOR POWER SYSTEM ELECTRICITY

Load Frequency Control Generator for Power System Electricity have balanced between Generator of load change occur, so frequency deviation due to load changes can be returned to original frequency. The Frequency of generator depending on the speed of rotation pramover is controlled by Governor. So governor design model very influential on Load Frequency Control Generator. Figure1 and Figure 2 is discription of Fixed Droop Governor system model and Conventional PID Governor system model.

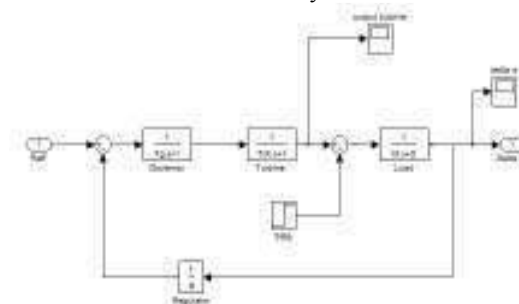


Figure 1. Fixed Droop Governor Model for Load Frequency Control

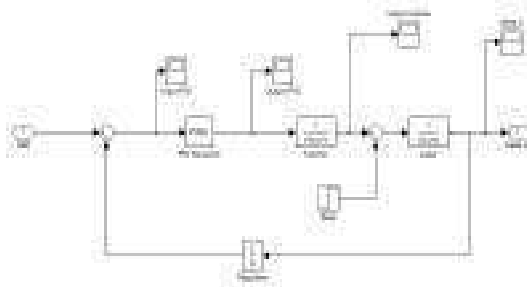


Figure 2. Conventional PID Governor Model for Load Frequency Control

Governor input and output equation from block model :

$$\frac{1}{T_g s + 1} = \frac{\Delta \dot{Y}}{\Delta u - \left(\frac{1}{R}\right) \Delta \omega}$$

$$\Delta \dot{Y} = \frac{1}{T_g} \Delta u - \frac{1}{R T_g} \Delta \omega - \frac{1}{T_g} \Delta Y \quad (1)$$

Turbin Equation diagram block model :

$$\frac{\Delta P_m}{\Delta Y} = \frac{1}{T_{ch} s + 1}$$

$$\Delta \dot{P}_m = \frac{1}{T_{ch}} \Delta Y - \frac{1}{T_{ch}} \Delta P_m \quad (2)$$

Speed angle rotor equation diagram block model :

$$\frac{\Delta \omega}{\Delta P_m - \Delta P_l} = \frac{1}{M s + D}$$

$$\Delta \dot{\omega} = \frac{1}{M} \Delta P_m - \frac{D}{M} \Delta \omega - \Delta P_l \quad (3)$$

From equation 1, 2 and 3 we have state space matrix equation :

$$\begin{bmatrix} \Delta \dot{Y} \\ \Delta \dot{P}_m \\ \Delta \dot{\omega} \end{bmatrix} = \begin{bmatrix} -\frac{1}{T_g} & 0 & -\frac{1}{R T_g} \\ \frac{1}{T_{ch}} & -\frac{1}{T_{ch}} & 0 \\ 0 & \frac{1}{M} & \frac{D}{M} \end{bmatrix} \begin{bmatrix} \Delta Y \\ \Delta P_m \\ \Delta \omega \end{bmatrix} + \begin{bmatrix} \frac{1}{T_g} & 0 \\ 0 & -1 \end{bmatrix} \begin{bmatrix} \Delta u \\ \Delta P_l \end{bmatrix}$$

## FUZZY – PID CONTROLLER

### 1. Governor Using Fuzzy-PID Controller model

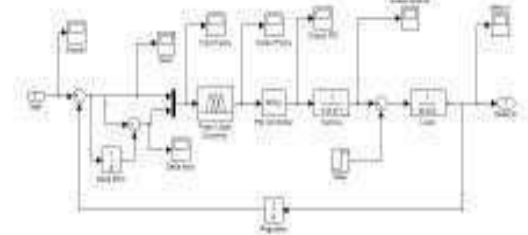


Figure 3. Governor Using Fuzzy-PID Controller for Load Frequency Control Generator

### 2. Membership Function and Fuzzy Rules

Fuzzy logic model input and output for speed governor.

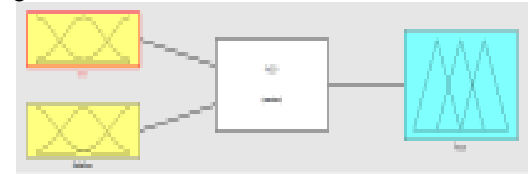


Figure 4. Fuzzy logic model input and output Governor model

Structure of Fuzzy logic control is represented of figure 5 and comprises three principle [4] :

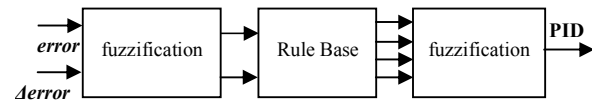


Figure 5. Simple Fuzzy logic structure

### Fuzzification

The fuzzification is convert input error speed and delta error speed to suitable linguistic value. There are two input seventh triangular input membership as show in figure 6 and 7.

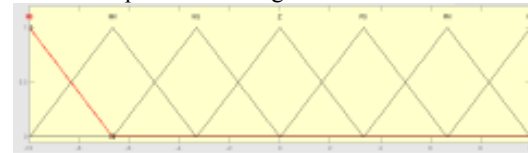


Figure 6. Membership Function Fuzzy Input speed error

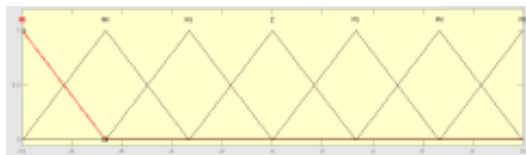


Figure 7. Membership Function Fuzzy Input speed delta error

#### Fuzzy Rule Base (Fuzzy Inference System)

The fuzzy rule base have mamdani model and TSK Sugeno model. This paper used mamdani model fuzzy inference. Fuzzy linguistic labels are Negatif Big (NB), Negatif Medium (NM), Negatif Sort (NS), Zero (Z), Positif Sort (PS), Positif Medium (PM), Positif Big (PB). Table fuzzy rule base is shown in Tabel 1, Fuzzy Rule Base and Fuzzy rule surface in figure 8 and figure 9.

Tabel 1. Fuzzy Rule Base for determining Output to PID

$\Delta E \backslash E$	NB	NM	NS	Z	PS	PM	PB
NB	nb	nb	nb	nb	nm	nm	Z
NM	nb	nb	nm	nm	ns	z	ps
NS	nb	nm	ns	ns	z	ps	pm
Z	nm	nm	ns	z	ps	pm	pm
PS	nm	ns	z	ps	ps	pm	pb
PM	ns	z	ps	pm	pm	pb	pb
PB	z	ps	pm	pb	pb	pb	pb

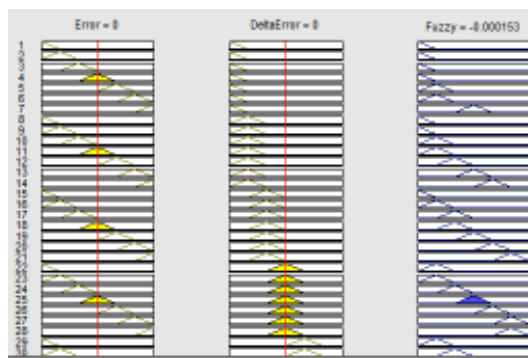


Figure 8. Fuzzy Rule Base for determining Output to PID

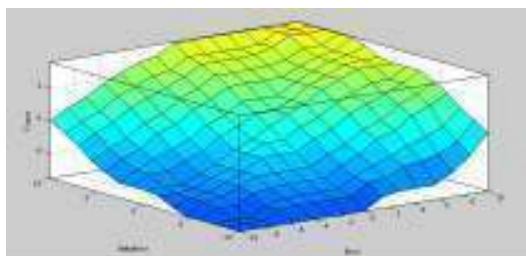


Figure 9. Fuzzy Rule Base Surface View (3D)

#### Defuzzification

Defuzzification is change fuzzy output to crisp value by predetermined membership function. There are various method has been successfully applied defuzzification for a variety problem. Here is 5 metode of defuzzification that is :

1. Centroid method (used this paper)
2. Heigh method
3. First (or Last) of Maxima
4. Mean - Max methode
5. Weighted Avarage

#### RESULT AND DISCUSSION

Simulation is done using SIMULINK MATLAB 2010b on similar parameter and unit step to Fixed droop governor model, PID Governor Model and Fuzzy PID Governor model. The Result simulation fixed droop governor, PID Governor and Fuzzy PID Governor is show in figure 10, figure 11 nd figure 12.



Figure 10. Fixed droop governor model with unit step simulation



Figure 11. PID governor model with similar parameter and unit step

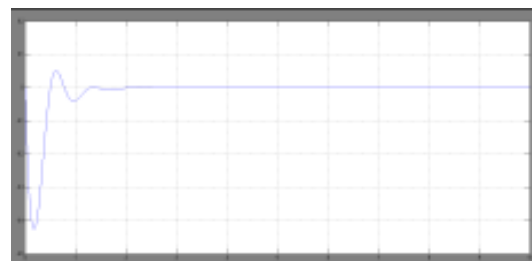


Figure 12. Fuzzy PID governor model with similar parameter and unit step simulation

## CONCLUSION

The result of simulation with MATLAB SIMULINK, the fixed droop governor model is not stable if get load disturbance (unit step), with similar parameter and unit step a PID Governor model can make frequency stabilized by tuning Proportional ( $K_p$ ), Integral ( $K_i$ ) and Derivative ( $K_d$ ). Fuzzy-PID control governor model is better than PID Control Governor because Droop and Overshoot Load Frequency Fuzzy PID Control Governor is smoother than PID Control Governor. So Fuzzy PID Control Governor model can reduce damage a parameter.

## Reference

- [1] Imam Robandi, "Modern Power System Control" Penerbit ANDI, Yogyakarta, 2009.
- [2] Imam Robandi, "Desain Sistem Tenaga Modern", Penerbit ANDI, Yogyakarta, 2006.
- [3] Hadi Saadat, "Power System Analysis" McGraw-Hill, 1999.
- [4] Muhammad M. Ismail, M.A. Mustapa Hasan "Load Frequency Control Using Artificial Intelligent Technique For One and Two Different Areas Power System", International Journal Of Control, Automation and System Volume.01 No.1. January 2002.

## DESIGN MODEL OF STATCOM USING PID CONTROLLER

Ario P H<sup>1)</sup>, Hermansyah<sup>2)</sup>, Farid D M<sup>3)</sup>, Ratih M S<sup>4)</sup>, Imam Robandi<sup>5)</sup>

Institut Teknologi Sepuluh Nopember Surabaya  
Jalan Kampus Its Raya, Sukolilo, 60111, Indonesia

<sup>1)</sup>ario.pamungkas.harahap13@mhs.ee.its.ac.id

### Abstract

The stability of a power system is indispensable. In the main power system equipment used in transmission systems FACTS (Flexible AC Transmission System) as an application to improve the power factor or the quality of the power of the initially generated at the power plant to go to the consumer or load. FACTS equipment there are many types, one type of equipment is STATCOM. STATCOM or Static Synchronous Compensator called a system which has multiinput and generate multioutput (MIMO). Right on STATCOM modeling is needed to improve the stability of the transient conditions. Therefore one of the methods used PID control is to keep the characteristics of STATCOM in order to provide system stability

**Keywords:** STATCOM, PID, power factor, converter

### Introduction

In electric power transmission system, the stability of the transient condition is indispensable to facilitate the distribution of power or electric power to the load from the generator to the load needs to tersupply so well by plants. Therefore, equipment FACTS (Flexible AC Transmission System) is used to improve the power factor of the load to the generator. Used in this study is one of the FACTS equipment STATCOM (Static Synchronous Compensator) to address and correct the change in voltage, power factor and stability of the system.. Control methods used in this study is the PID. The use of this control method aims to obtain a faster response time so that when there is a short and rapid changes in the parameters of the

power system STATCOM can follow these changes to maintain system stability.

### METHOD

Modeling on STATCOM (Static Synchronous Compensator) which refers to the VSC (Voltage Source Converter). The use of components of the STATCOM switching MOSFET or IGBT is because it takes time fast switching.

Equation STATCOM modeling system can be described:

$$i_p = \begin{bmatrix} Dap - Dbp \\ Dbp - Dcp \\ Dcp - Dap \end{bmatrix}^T \begin{bmatrix} i_{ab} \\ i_{bc} \\ i_{ca} \end{bmatrix} \dots\dots\dots (1)$$

$$\begin{bmatrix} Va - Vb \\ Vb - Vc \\ Vc - Va \end{bmatrix} = \begin{bmatrix} Dap - Dbp \\ Dbp - Dcp \\ Dcp - Dap \end{bmatrix} V_{pm} \dots\dots\dots (2)$$

$$L \frac{di_{ab}}{dt} = \frac{1}{3} L \left( \frac{di_a}{dt} - \frac{di_b}{dt} \right) \dots\dots\dots (3)$$

STATCOM dynamic equations in state space form:

$$\frac{d}{dt} \begin{bmatrix} id \\ iq \\ Vdc \end{bmatrix} = \begin{bmatrix} \frac{-R}{L} & \omega & \frac{-Dd}{3L} \\ -\omega & \frac{-R}{L} & \frac{-Dd}{3L} \\ \frac{3Dd}{2C} & \frac{3Dd}{2C} & 0 \end{bmatrix} \begin{bmatrix} id \\ iq \\ Vdc \end{bmatrix} + \begin{bmatrix} \frac{3}{L} \\ 0 \\ 0 \end{bmatrix} V_m \dots\dots\dots (4)$$

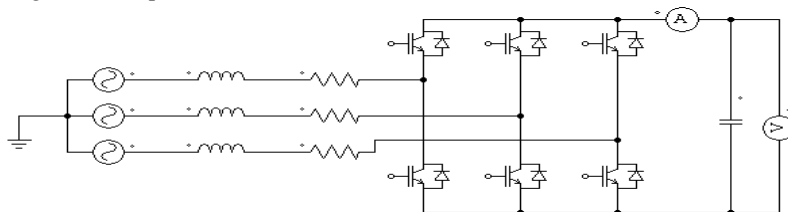


Figure 1. Circuit of STATCOM

## RESULT AND ANALYSIS

In this research, a simple simulation in order to obtain results which have been controlled by a PID controller. In this study, the value obtained for the transfer function of the system:

$$TF = \frac{1863916,43}{610,687S + 1553263,69}$$

And the calculation of the value of Kp, Ki, and Kd:

$$k_p = \frac{\tau_i}{\tau \cdot K} = \frac{0,00003932}{0,0008 \cdot 1,2} = 0,04096 \quad \dots(5)$$

$$k_d = k_p \tau_d = 0,0008 \cdot 0,01637 = 0,0000131 \quad \dots(6)$$

$$k_i = \frac{k_p}{\tau_i} = \frac{0,04096}{0,00003932} = 1041,70 \quad \dots(7)$$

Determination of parameters of proportional, integral and derivative done by calculating equation (5), (6) and (7). But still must be set back when when observed on the output waveform is still not looking good. Setting back can be done on components Kp or Ki or Kd to obtain a stable system

The Waves that have a high overshoot, the system can be said to have not been well controlled. This wave states how state-controlled parameters on the system so that its value can be determined by looking at the system output wave.

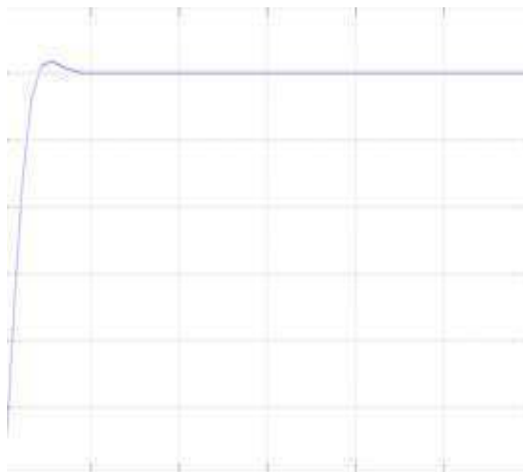


Figure 2. Output waveform of the system

In this study, the changed value of the calculation are Kp = 0.04096 be Kp = 0.3. This change was made at random to obtain the desired output waveform

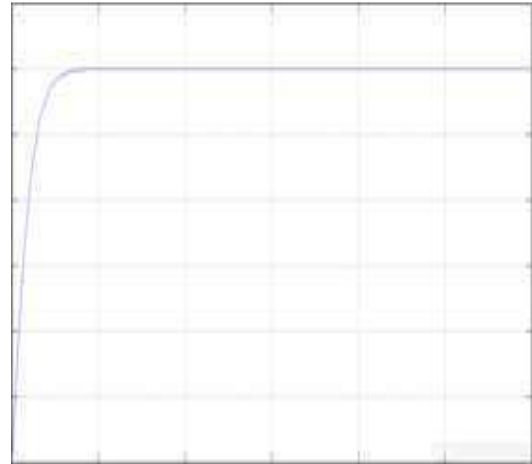


Figure 3. Output waveform of the system by tuning Kp

If still not obtained the appropriate wavelength tuning can be performed kompone such as Kd or Ki to obtain the corresponding output waveform.

## CONCLUSION

STATCOM model design using the PID controller is represented in state space form which can then be searched transfer function of the system. It can be seen that the PID controller can generate the expected outputs in the system. With the determination of the parameters Kp = 0.3 then Kd = 0.000031 and last Ki of 1041.70. The results of both systems can be seen from the waveforms found in simulink.

## Reference

- [1] Robandi, Imam. "Desain Sistem Tenaga Modern". ANDI: Yogyakarta. 2006.
- [2] Robandi, Imam. "Modern Power Sistem Control". ANDI: Yogyakarta. 2009.

## EXCITATION CONTROL SYSTEM DESIGN TO IMPROVE VOLTAGE STABILITY IN A SINGLE MACHINE INFINITE BUS SYSTEM (SMIB) METHOD USING PID

**Hermansyah, Aji Akbar Firdaus, Ratih Mar'atus Sholihah,  
Farid Dwi Murdianto, Imam Robandi**

Electrical Engineering Institute of Technology Sepuluh Nopember

Email: ancha\_belawa@yahoo.co.id

### **Abstract**

*This type of control is often used directly in the voltage control system excitation SMIB system. The function of controlling the excitation voltage to maintain stability in the SMIB system. To get the most reliable control system is needed so that the desired stability can be achieved. By using the software MATLAB and PID method, the system will show the results of the Institute of Electrical excitation at SMIB.*

### **INTRODUCTION**

Over time, requirement of electrical power is growing. This case will impact to excitation voltage stability of the power system specifically to SMIB system. Stability of voltage from the system very necessary to endure. For keeping stability of the power we need to design the system of control which is reliable and exactly. Excitation of control is very useful if electrical power system have voltage instability in the system itself.

Instability in the electrical power of system will have bad impact on the system and the consumer. Up and falling of the voltage will impact quality of the voltage and reactive power. To solve this problem we need excitation system which is reliable so a stable voltage can be obtained. Excitation system in the SMIB works to keep the voltage and reactive power raised by the generator in order to remain stable at the desired. If reactive power has increase, then on the load side will have a drop voltage and will have an impact on consumers.

The control from signal gain settings or usually named with gain on excitation system will control a voltage so excitation voltage on the power plant will stable at the voltage level which is expected. Stable excitation voltage on the generator will stabilize the voltage and reactive power at the load side or consumer. It is very necessary to be considered because it can affect the stability of reactive power and voltage electric power system.

### **METHOD**

In looking at the response of the voltage stability and power on the System Single Machine Infinite Bus (SMIB) using PID method and run it using Multisim facilities contained in the MATLAB software. PID method is a method which is very simple and an effective method for a control system. This method is used by most of the industries in which there are control because its operation is relatively easy and not too complicated for a beginner in the field of control systems

In determining the PID control parameters, is done by trial and error to achieve the characteristic parameter values corresponding component with the working principles of each of these components. And the following is a PID control algorithm baited blocks behind.

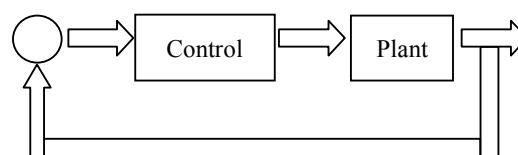


Figure 1. PID Algorithm

Equation or transfer function of the PID controller is as follows:

$$K_p = \frac{K_1}{s} + K_D s = \frac{K_D s^2 + K_p s + K_1}{s}$$

Where :

$K_p$  = Proportional Gain  
 $K_I$  = Integral Gain  
 $K_D$  = Derivatif Gain

The PID method aims to find the stability conditions which is expected. This method has a reference on rise time or rise time and the difference in value of the insulation should have a stability limit of the previous value, and if the steady state error approaches the expected value of the response can be said to be stable.



## RESULTS AND ANALYSIS

Here is a simple block diagram of the voltage control system a Single Machine Infinite Bus (SMIB):

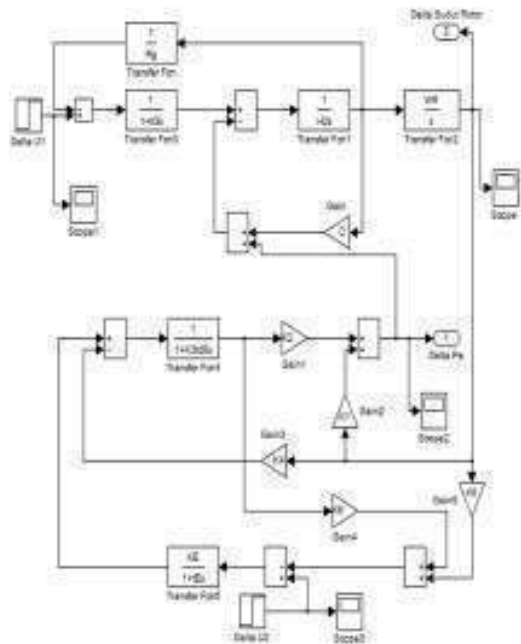


Figure 2. Blok diagram kontrol tegangan pada SMIB

The change of the excitation field  $\Delta E_{FD}$  voltage generated by the reference voltage changes  $\Delta U_2$  or terminal voltage  $V_t$ . If it is assumed that  $\Delta U_2 = 0$  and transducers do not have a time lag, it just depends on  $\Delta V_t$   $\Delta E_{FD}$  modified by the transfer function of the excitation system. Equation in the domain (s) relationship between excitation voltage changes  $\Delta E_{FD}$  with synchronous machine terminal voltage changes  $\Delta V_t$  Equality can be seen in the following:

$$\Delta E_{FD} = -K_E / (1 + \tau_E s)$$

Where :

$K_E$  : Amplifier control

$\tau_E$  : Time constant control

$\Delta E_{FD}$  :Excitation field voltage changes

s : Domain

Figure 2 The following are the results of simulation using MATLAB software and parameters determination method of PID:

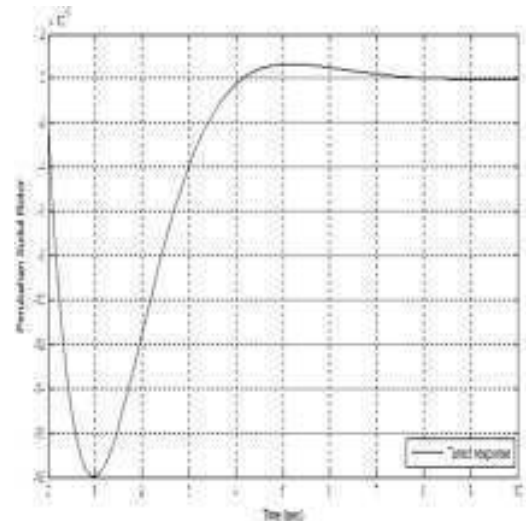


Figure 3. RotorAngleChanges

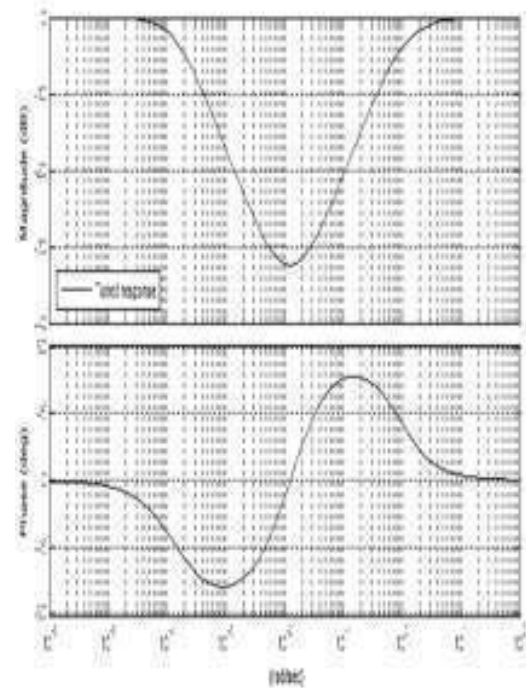


Figure 4. Voltage Changes

## References

- [1] Hadi Saadat, *Power System Analysis*, McGraw Hill, New York, 1999.
- [2] Imam Robandi, Prof, *Desain Sistem Tenaga Modern*, Andi, Yogyakarta 2006.
- [3] Imam Robandi, Prof, *Modern PowerSystem Control*, Andi, Yogyakarta 2009.

## FREQUENCY STABILITY IMPROVEMENT ON SINGLE MACHINE SYSTEM USING FIRST ORDER POWER SYSTEM STABILIZER

Nita Indriani Pertiwi<sup>1)</sup>, Mei Adetya<sup>2)</sup>, Andi Imran<sup>3)</sup>, Abil Huda<sup>4)</sup>, Imam Robandi<sup>5)</sup>

<sup>(1,2,3,5)</sup>Institut Teknologi Sepuluh Nopember, Surabaya

<sup>(4)</sup>Universitas Borneo Tarakan, Kalimantan Utara

E-mail: nitaindrianipertiwi@gmail.com

### Abstract

*The stability of a power system will ensure the continuity and reliability of a system. Therefore, efforts to maintain the stability of a system is a very important thing. This Paper presents the improved frequency response on the single machine system with the addition of First Order Power System Stabilizer (PSS) on generator excitation system. PSS will help dampen the oscillations on frequency that occur due to the interruption of the load changes. With the addition of First Order PSS generated better frequency response.*

### BACKGROUND

The stability of the power system is a very important issue. The stability can be defined as the ability of a power system to be able to go back on a normal condition in the event of a failure. Views of the causes of the interruption, the stability analysis of the power system is divided into three categories, namely the stability of steady-state, transient and dynamic. Steady-state stability of power system is the ability to get back on the state in sync (normal) after the occurrence of such a small change of load disturbance. Dynamic stability is the ability to return to normal after a minor annoyance at peak loads. Transient stability associated with major disruption occurs unexpectedly in a short period as a brief relationship disorders. Instability of the power system can have the a negative impact on the system, this is cause loss of synchronous on generator. One of the causes of instability is due to the change of the load on the generator. This resulted oscillations in the frequency and angle rotor of the generator. If the stability problem cannot be resolved then this will cause the disconnection of power supply.

There are three important things in the problems of stability, the stability of frequency, voltage and angle rotor stability. Frequency stability is the ability to keep the power system frequency remained stable at the frequency rated when fault occur. Voltage stability refers to the ability of the system to maintain the voltage at each bus on the value rating. While the stability of rotor

angle refers to the ability of the system to be able to maintain the condition of a synchronous generator.

One of the causes of the occurrence of disorder instability is due to the change of the load on the generator. Changes to the load on the power system greatly affects the conditions of the frequency and angle rotor generator. When the load goes up, then the frequency will decrease in contrast when the load goes down then the frequency will be increased. This has resulted in the onset of oscillation frequency and angle rotor generator. Various methods have been made to improve the performance of the stability of the power system. One of them is by adding extra equipment on the generator excitation system PSS or Automatic Voltage Regulator (AVR).

PSS is an additional control function blocks to help the curbs against the rotor oscillations by controlling the excitation of generator using the generator signal stabilization [1]. When the system is experiencing disruptions due to changes in the load, frequency deviation angle is going to arise, so the PSS must be designed in order to compensate for the angle of deviation.

### METHOD

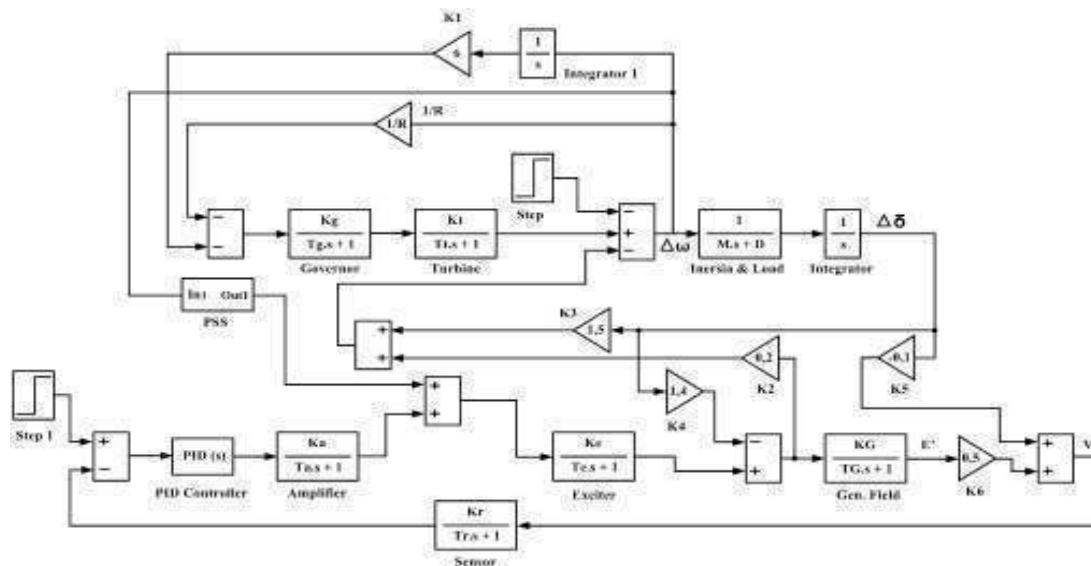
#### A. Block Diagram of Single Machine

Single Machine system consists of a synchronous generator is equipped with a governor, excitation systems and turbines also AVR. The turbine is used to rotate the rotor generator. This turbine will be rotated using certain sources of energy such as wind, water, coal, and others. Whereas the system of excitation function in order to provide a current dc in rotor generator so it will be produced voltage when the rotor rotated.

Meanwhile, Governor and AVR is a control system in the power system. Governor is used to control the amount of energy used to spin the turbine. The magnitude of the energy will be given by the governor to the turbine will be adapted to changes in the frequency of the generator. AVR is used to set the amount that will be given to the excitation of the generator. The value of the excitation voltage is adjustable with the changes

that occur in the generator. Block diagrams are used in this paper is the block diagram of single machine system in general, but the parameters used obtained from reference [3]. The parameters of the block diagram can be seen in table 1.

From Figure 1 it can be seen that the first order PSS block has been added to the system. In addition there is also a PID controller where the parameters of the controller are also obtained from references.



Gambar 1. Block Diagram Single Machine System with Power System Stabilizer

Tabel 1. Single Machine Parameters

Parameter	Gain (K)	Time Constant (T)
Turbine	1	0,5
Governor	1	0,2
Amplifier	10	0,1
Exciter	1	0,4
Generator	0,8	1,4
Field		
Sensor	1	0,05
Inertia		10
Regulation		0,05

Tabel 2. PID Parameters

Parameter	Nilai
Kp	1
Ki	0,25
Kd	0,3

### B. Power System Stabilizer (PSS)

PSS basically consists of a series of blocks placed on excitation control of synchronous generator and AVR. This block consist of Gain,

Washout Filter and Lead/Lag blocks as can be seen in the picture below.

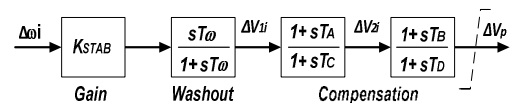


Figure 2. Diagram Block of PSS Conventional [2].

Gain blocks serve to organize the reinforcement in order to obtain the desired quantity, Washout block High Pass Filter is a Filter that will set the on-off of the PSS block while the Lead/Lag or compensation serves to set up conditions lag between the input torque and excitation of generators. Input from PSS it can be either a frequency response or a generator rotor speed obtained from the system. However, in this paper the input frequency used is the PSS of rotor generator. This response will be further processed on the PSS output signal is obtained so that it will be provided on the system the excitation of the generator. Because on paper it used only one order, then the PSS block diagram of PSS are as in Figure 3.

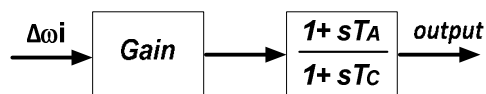


Figure 3. Diagram Block First Order PSS

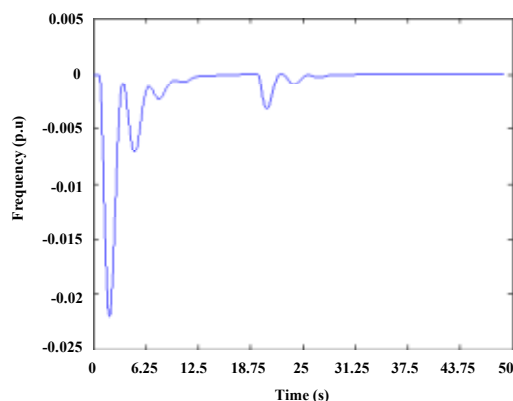


Figure 4. Frequency Response when the load changes

As seen in Figure 3, to designing first order PSS then needs to obtain three parameters, there are Gain, TA and TC. To get the parameters, the first step to do is to observe the frequency response of the system before using the PSS when there are changes to the load.

Simulation results obtained from the frequency of the oscillations that occur at a frequency response generator when there is a change of the load. The frequency of this oscillation will be used to get the angle using a single machine system excitation block.

$$\text{Transfer Function excitation} = \frac{1}{K_e s + 1} \quad (1)$$

Equation (1) in the form of the Laplace equation is converted in the form  $j\omega$  equation (2) such as below.

$$\frac{1}{K_e s + 1} = \frac{1}{K_e j\omega + 1} \quad (2)$$

$$\frac{1}{K_e j\omega + 1} = \frac{1 \angle 0^\circ}{\sqrt{1^2 + (K_e \omega)^2} \angle \tan^{-1} \frac{K_e \omega}{1}} \quad (3)$$

$$\Theta_{\text{eksitasi}} = 0^\circ - \tan^{-1} \frac{K_e \omega}{1} \quad (4)$$

From equation (4) then it will get the value of the angle of deviation frequency response systems when there is a change of the load. In order to be able to compensate for irregularities in the PSS

frequency response or frequency response to be returned to stable condition, then the  $\Theta_{\text{PSS}}$  must be the inverse value from the  $\Theta_{\text{eksitasi}}$ .

The Transfer function of the PSS obtained from diagram in Figure 3 blocks. From the transfer function of PSS and the known values of  $\Theta_{\text{PSS}}$ , the value of  $T_A$  and  $T_B$  will be obtain. To get the value of  $T_A$  and  $T_B$  then it must be determined in advance one of the value of  $T_A$  or  $T_B$ .

$$\Theta_{\text{PSS}} = \tan^{-1} \frac{T_A \omega}{1} - \tan^{-1} \frac{T_B \omega}{1} \quad (5)$$

From the calculations then obtained PSS parameters can be seen in table 2.

Tabel 3  
PSS Parameters

Parameter	Value
Gain (K)	100
$T_A$	30
$T_B$	29.32

## SIMULATION RESULT AND ANALYSIS

Stability analysis on this paper will be done by observing the frequency response as well as the angle of the rotor before and after using the PSS. Otherwise it will be seen also errors that occur at a frequency response system both before and after using the PSS. The second response will be compared so as to dianilisis the influence of the use of PSS on system single machine.

### A. Frequency Response

To test the stability of the system is then given the disruption in the form of changes to the load on the 20th minute with load change of 0.05 pu. Change the load on simulation is done by giving the step function input. Simulation results obtained from the results of the response changes frequency in units of per unit (pu) which is shown in Figure 3. A stable system that is supposed to have a frequency response which is fixed at the point 0. In addition to the stability of the system can also be seen from the time required by the system to get back on a stable condition. From the picture below, the red graph shows frequency response before using PSS while blue is the frequency response graph after using the PSS.

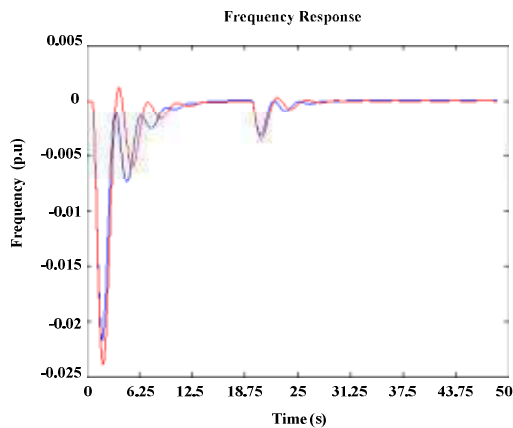


Figure 5. Frequency Response

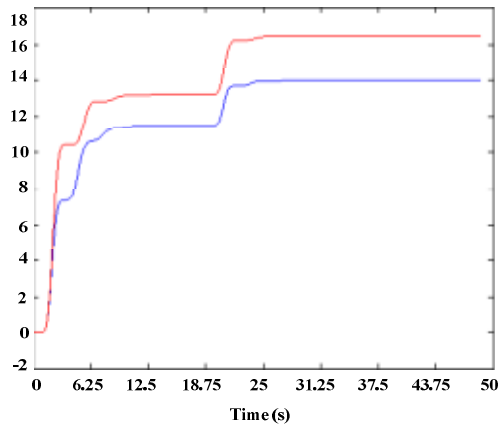


Figure 6. Error in frequency response

From the graph in Figure 3 shown that with the addition of PSS on system reduces oscillations in the frequency of the system. Besides the time it takes to return frequency on stable condition on the system with the PSS faster compared to systems without PSS. When conducted observation of frequency response error of the two graphs can be seen that the system does not use the PSS have a greater error than systems with PSS. This observation is done by looking at the area of deviation frequency response against the stable point (0). This can be seen in Figure 4.

## B. Rotor Angle Response

In addition conducted observations on the response of the rotor angle as shown in Figure 7.

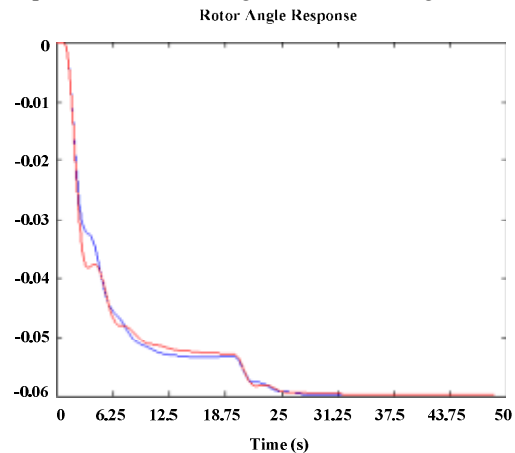


Figure 7. Rotor Angle Response

From the picture above, the red graph shows the response of the rotor before using PSS and blue graph is the rotor angle when using the PSS. From these two graphs can be seen that the use of the PSS can reduce oscillations on the rotor angle of the generator.

## CONCLUSION

Simulation results show that the addition of PSS on a single machine system can reduce the oscillations due to load changes. However, stability improvements obtained before and after using the PSS is not significant due to the lack of optimization of PSS parameters. With the optimization of the parameters of the PSS it will get better stability improvements.

## Reference

- [1] P. Kundur, "Power System Stability and Control", McGraw-Hill, Inc, New York, Ch. 12. 1994.
- [2] Robandi, Imam. "Desain Sistem Tenaga Modern", Penerbit ANDI, Yogyakarta. 2006.
- [3] Saadat, H., "Power System Analysis", Second Edition, McGraw-Hill International Edition, Singapore, 2004.

## DESIGN AND DEVELOPMENT OF THE DC-TO-DC CONVERTER FOR HIGH POWER LED

**Mochammad Rif'an, Nanang Sulistiyanto, Rahmadwati, Onny Setyawati**

Electrical Engineering Department, Brawijaya University  
Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166  
Email: rifan@ub.ac.id, nnst@ub.ac.id, osetyawati@ub.ac.id

### **Abstract**

*This paper presents the development of the LED driver design and its prototype based on FPGA module for high power LED. The boost converter was selected as the optimum power converter topology which showed relatively high efficiency. Model simulation by B<sup>2</sup>SPICE software, and measurements test of the FPGA module were successfully performed.*

**Keywords:** LED driver, power converter, B<sup>2</sup>SPICE

### **BACKGROUND**

Over last few years, many research have been work in obtaining quality durable lamp with high light intensity and low power required. Light Emitting Diode which commonly known as LED is a type of light that has many advantages than conventional light bulbs. In recent years, LEDs lighting technology has been offered. Whereas in previously LED technology is used for indicator only which requires a low intensity but long lasting. Commonly, the LED lights are offered in the market have 30,000 hours life time and low power consumption. It can be compared with a light bulb or Cathode Fluorescent Lamp (CFL).

High intensity light can be obtained by combining the number of LEDs or using a LED with high power. As consequence there is an enlargement dimension. Both methods still lead self heating, although still lower than light bulb, so it remains the investigation LED technology that can reduce self heating phenomenon.

Main component in LED system is the driver. LED driver can be categorized into constant current type (350mA, 700mA and 1A) or voltage type (generally 10V, 12V and 24V). Driver design is normally compact in packaging into a junction box and directed to have dimming and LEDs sequencing abilities [DiLouie, C., 2004]. For general lighting, Infineon [Infineon Technologies AG, 2007] produced low-cost LED Driver which was designed for 10 up to 65 mA.

Power converter circuit in a LED driver for high voltage application [Hu, Q., 2010], and also

converter circuit designed for power efficiencies [Leung, W.Y., 2008] had been published.

Mednik reported that the optimal converter topology was buck converter. The circuit had ability to step-up and/or step-down of the input voltage, and prevented the LED load from electrical transient [Mednik, A., 2005].

LED needs to have a certain current level in order to be able to emit high intensity without causing an early damage. LED can be ignited by a voltage regulator, wherein a regulator switching works very efficient as LED driver.

The work frequency of PWM (Pulse Width Modulation) in the regulator switching should also be defined properly. As LED current increased, the driver should be optimized to reach the realistic operation range, and the specific application. Smart driver would have many features such as no-flickering, dimming, remote LED fixture monitoring, and custom colour setting [Signorino, I., 2009].

This research is focused on development of design and realization of the LED driver prototype which has high efficiency and low power consumption and dedicated for a specific high power LED, which has better temperature resistance than the conventional 5-mm white LED [Narendran, N., 2004].

### **METHOD**

#### **Design and Simulation of the Power Converter**

Several topologies of power converter were simulated. The simulation model was performed using B<sup>2</sup>SPICE software, with variation of the inductances value and duty cycle. The simulation results were analyzed, and also the measurement results of the prototype controller, to obtain certain output voltages.

Figure 1(a) shows an illustration of the boost converter [microchip AN1207]. The simulation showed that increasing the inductance value (L) (see Fig. 1(b) and (c)) would reduce overshoot before the output reached its steady state, which was the same case for the buck converter. However, the L in the boost converter influenced

the output voltage at time  $t=0$ . Figure 2 shows the cuk converter which was simulated for its duty cycle. Its output voltage was 42.6 V at duty cycle of 90%, meanwhile the buck-boost converter revealed only 20.6 V.

#### Controller using FPGA Module

Driver design was implemented using an FPGA module as switching controller. The main reason using FPGA was its flexibility to adjust the switching timing. Tests of this prototype were evaluated based on their simulation results. Figure 3 shows the FPGA module used for the driver. Input current  $I(t)$  converted into digital information  $I(n)$  by the analog-to-digital converter (ADC). Hence,  $I(n)$  was an input to the controller P-I, then the output duty cycle  $D(n)$  from the controller became an input to the Pulse Wave Modulation (PWM) generator.

#### RESULTS AND DISCUSSION

The results presented in the following are from the test measurement of the FPGA module, the output of the boost converter and the driver's set up measurement using LED as its load.

The simulation of the FPGA module is capture in Figure 4(a), showing that the PWM frequency was 100 kHz and the duty cycle was 10%, the simulation was performed using Xilinx ISE14.6. The measurement test resulted in the duty cycle of 10.1% as shown in Figure 4(b), wherein the output voltage was 3.76 V.

The converter's measurement can be seen for the boost topology in Figure 5. A filter was required to smooth the output voltage which was detected during the measurements (Fig.5(a)). Applying an electrolyte capacitor of 1000 $\mu$ F was able to reduce the problem (Fig.5(b)), however the spike was still unsolved. A high frequency capacitor, made of multilayer ceramics, of 47 nF was added to overcome this shortcoming. Finally the output voltages of the boost converter were clearly observed, as shown in Figure 5(c) and (d), at the duty cycle of 21.9% and 41.4%, respectively.

The boost converter was selected as the optimum topology for this experiment, since it had relatively the highest efficiency comparing to the others. The driver was built by the FPGA module and the boost converter. Several measurement tests for the driver were performed, to obtain the output voltages i.e. for the circuit without load, the circuit using the dummy load resistor and using LEDs. The measurement set-up using a lamp (Philips nominal 5W) as circuit load is shown in

Figure 6. The lamp consisted of 7 LEDs in series, the experiments were taken for various duty cycle (5% up to 90%), the input-voltage of the driver and also the output current were recorded. The output voltage of the driver of 20.5 V was measured.

#### CONCLUSION

The LED driver's design and prototype based on FPGA module has been successfully developed. Boost topology was selected as the optimum power converter which had relatively high efficiency. A filter consisted of an electrolyte capacitor parallel with a multilayer capacitor was required for smoothing the output voltage. During measurement test using an LED as load, the output of 20.5 V was obtained.

#### References

- DiLouie, C., 2004, "Controlling LED lighting systems: introducing the LED driver", LEDs Magazine, December 2004.
- Hu, Q., Zane, R., 2010, "LED Driver Circuit with Series-Input-Connected Converter Cells Operating in Continuous Conduction Mode", *IEEE Transactions on Power Electronics*, Vol.25, Issue 3, pp. 574-582, March 2010, doi.: 10.1109/TPEL.2009.2029337
- Infineon Technologies AG, 2007, "Low Cost LED Drivers for General Lighting: BCR 401, BCR 402, BCR 405", 2007.
- Leung, Wing Y., Man, T.Y., Chan, M., 2008, "A high-power-LED driver with power-efficient LED-current sensing circuit", *Solid-State Circuits Conference*, 2008. ESSC IRC 2008. 34<sup>th</sup> European, pp. 354-357. *IEEE Xplore*. doi.: 10.1109/ESSC IRC.2008.4681865
- Mednik, A., 2005, "Automotive LED lighting needs special drivers", *Power Electronics Technology*, August 2005.
- Narendran, N., Deng, L., Physar, R.M., Gu, Y., Yu, H., 2004, "Performance characteristics of high-power-light-emitting-diodes", *Proceedings SPIE* 5187, Third International Conference on Solid State Lighting, 267 (January 26, 2004); doi:10.1117/12.515647
- Microchip AN1207, Switch Mode Power Supply (SMPS) Topologies (Part II), 2009. Author: Antonio Bersani. Microchip Technology Inc., www.microchip.com
- Signorino, Irene, 2009, "Next-Generation Solid-State Lighting Fixtures Need Optimized LED Drivers", *Power Electronics*, September 2009

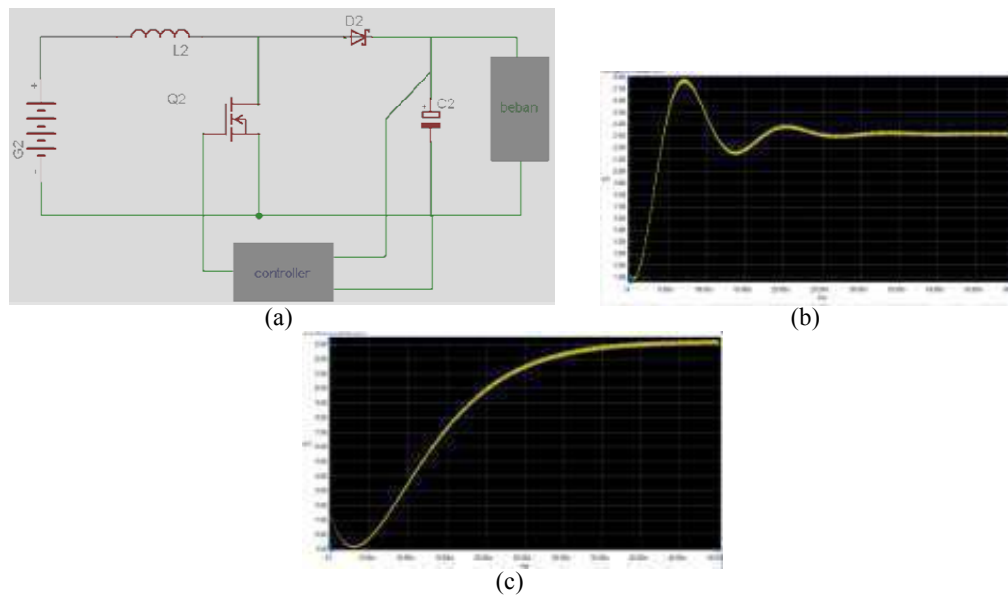


Figure1.(a) Boost converter topology (redraw after [microchip AN1207]). Simulation results  
(b) with inductance of 1 H (c) with inductance of 10 H

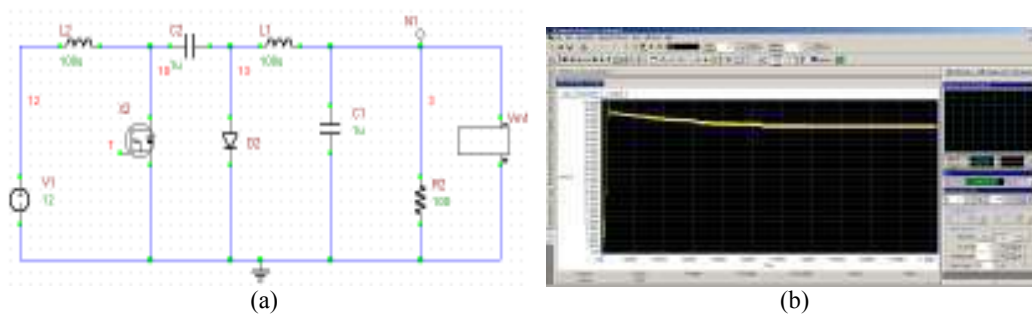


Figure2. a) Cuk converter design forsimulating the duty cycle as a function of the output voltage;  
b)The voltage of 42.6 V was recorded at duty cycle of 90%

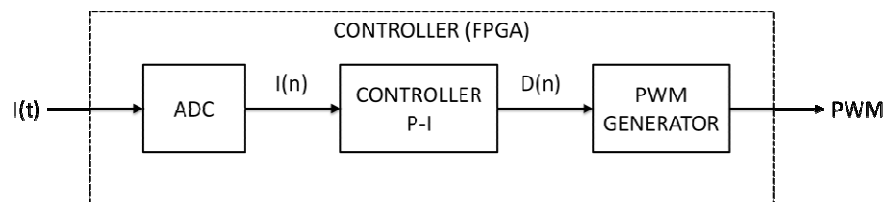


Figure 3. The scheme of the controller (FPGA module)



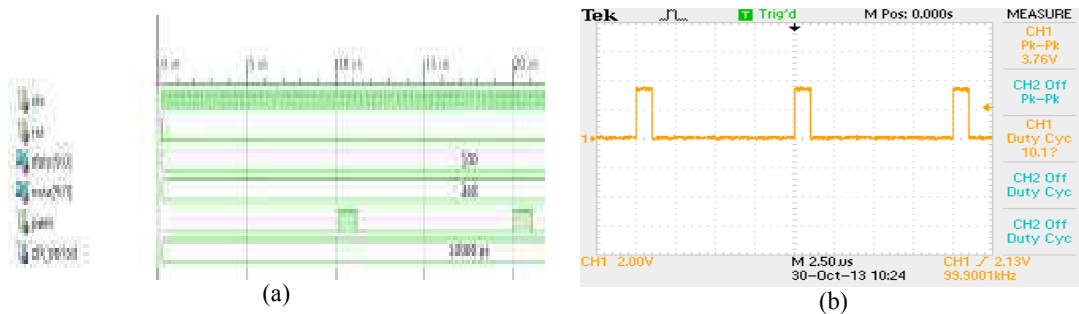


Figure 4. The a) simulation and b) output measurement results of the FPGA module

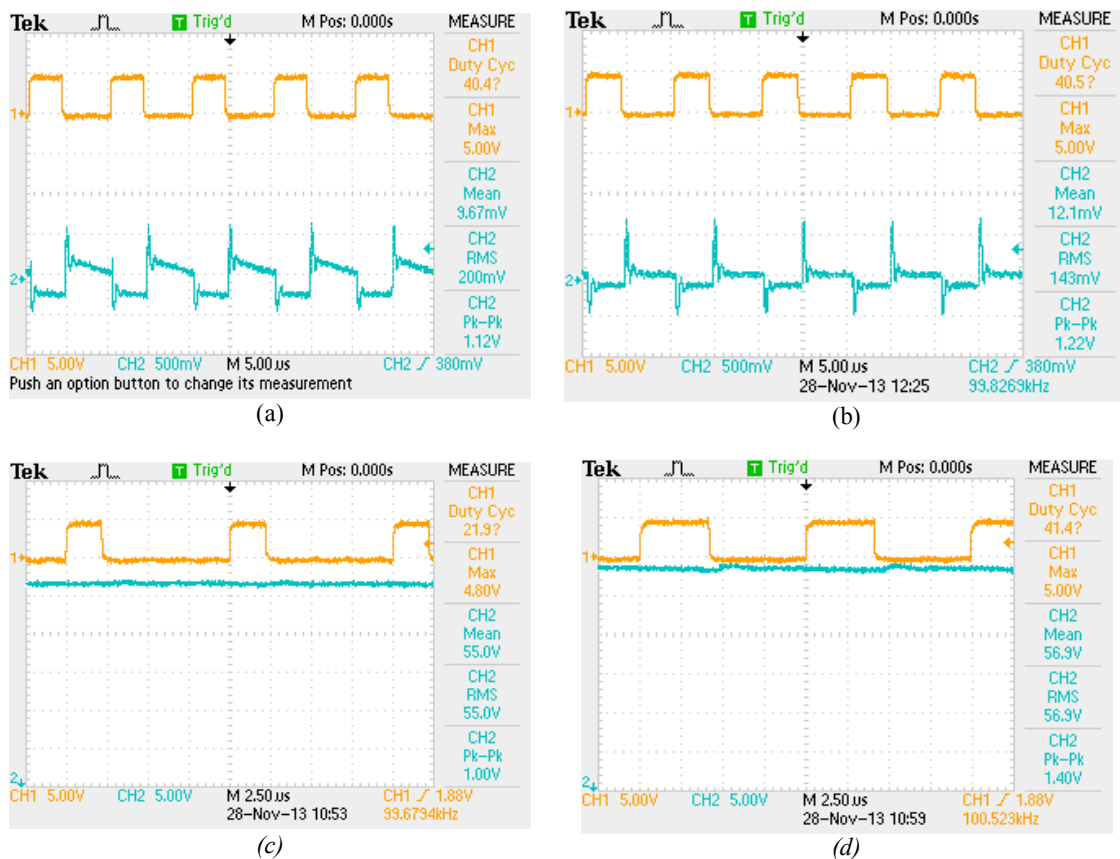


Figure 5. a) A measurement result showed the unsmooth output voltage of the boost converter circuit;  
b) Smoothing output voltage by filtering with an electrolyte capacitor, however the spikes were still unsolved;  
The result after parallel connection of the electrolyte capacitor with a 47 nF multilayer ceramic capacitor,  
c) output of 55 V was clearly obtained at duty cycle of 21.9% and d) output of 56.9 V at duty cycle of 41.4%

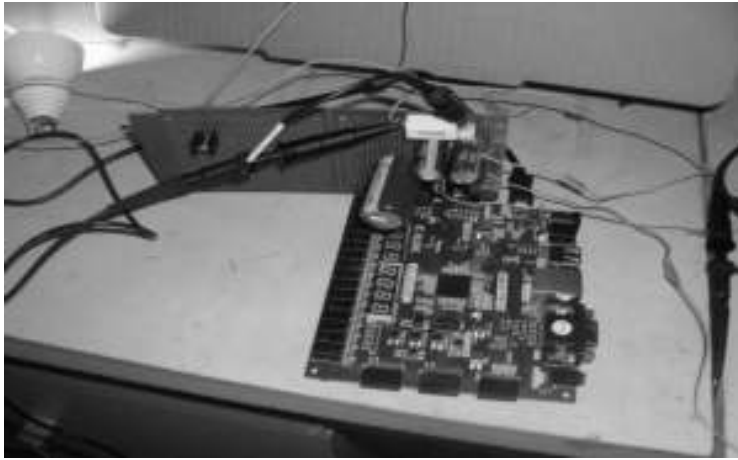


Figure 6. The measurement set up using LEDs as the circuit load. The duty cycle up to 90% was applied, and output voltage of 20.5 V was obtained

## SETTLING TIME CONTROL OF STEAM TURBINE POWER PLANT USING LINEAR QUADRATIC REGULATOR (LQR)

Ribka Stephani<sup>(1)</sup>, Nita I. Pertiwi<sup>(2)</sup>, Hidayatul Nurohmah<sup>(3)</sup>,  
Hilmansyah<sup>(4)</sup> dan Imam Robandi<sup>(5)</sup>

<sup>(1,2,4,5)</sup>Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember (ITS)

<sup>(3)</sup>Department of Electrical Engineering, Universitas Darul 'Ulum Jombang

### Abstract

*Steady State is an essential factor for steam turbine power plant to maintain the stability system. Steady State in the system can be reached faster with controller. This paper analyzes the comparison of settling time (the required time to reach steady state) on the steam turbine power plant without controller and with Linear Quadratic Regulator (LQR) using MATLAB simulation. The simulation results show the LQR controller makes the system stable and faster (0.76 seconds) to reach steady state than without using the controller. The best combination of the Q and R value will influence the time taken (duration) to reach steady state in the system.*

**Keywords:** Controller, Linear Quadratic Programming (LQR), Steam Turbine, Steady state

### INTRODUCTION

Power system stability is a significant factor in the operating system. At steady state conditions, a power plant can work properly [1].

The steam turbine will transform the steam to kinetic energy, that will turn a generator to produce electricity. The turbine rotation depends on load conditions. If the load increases, the rotation will be slow down and vice versa. Whereas, the frequency of the turbine rotation should be stable in order to make the turbine works properly.

Moreover, steam power plant also has another internal problem which influences the system stability. Thus having a controller, that is able to regulate the steam turbine rotation to be stable and faster to reach steady state, is the way to anticipate those problems above.

LQR is an optimal system of quadratic control methods that will help the system to reach steady state (settling time) [1].

The discussion of this paper will focus only on time comparison to reach steady state (settling time) on a steam turbine plant with and without LQR (Linear Quadratic Regulator) controller based on MATLAB simulation results. Since Q and R value are the determinants of the system to reach steady state, therefore this paper will reveal the best

combination of Q and R value by using trial and error method.

### METHOD

#### 1. Steam Turbine Plant Design

The steam turbine input is kinetic energy produced from steam kettle and the output is kinetic energy to drive the turbine.  $K_{gui}$ ,  $T_{gui}$ ,  $R_i$  and  $T_{ui}$  are the parameter of amplifier regulator steam turbine, steam turbine time regulator, constant steam turbine regulator and steam engine time response to-i (minutes) [1]. In this experiment the value of each parameter is displayed as follow:

$K_{gui}=2,3983$ ;  $T_{gui}=0,15$ ;  $R_i=0,05$ ;  $T_{ui}=0,4$ .

These parameters are used to set the state space formed by the blog diagram below:

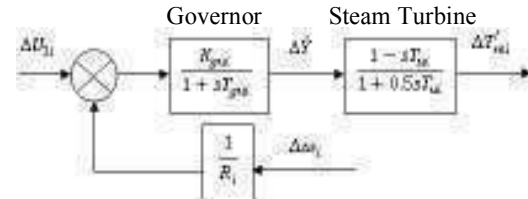


Figure 1. Blog Diagram of Steam Turbine

Based on the blog diagram above, it can form the following equation:

$$\dot{\Delta Y}_i = \frac{K_{gui}}{T_{gui}} \Delta U_{1i} - \frac{K_{gu} \Delta \omega_i}{T_{gui} R_i} - \frac{\Delta Y_i}{T_{gui}} \quad (1)$$

$$\dot{\Delta T}_{mi} = \left( \frac{2}{T_{ui}} + \frac{2}{T_{gui}} \right) \Delta Y_i - \frac{2K_{gui} \Delta U_{1i}}{T_{gui}} + \frac{2K_{gu} \Delta \omega_i}{R_i T_{gui}} - \frac{2\Delta T_{mi}}{T_{ui}} \quad (2)$$

Equation (1) and (2) will form a state space steam turbine as follow.

$$\dot{x} = Ax + Bu$$

$$\begin{bmatrix} \dot{\Delta Y}_i \\ \dot{\Delta \omega_i} \\ \dot{\Delta T}_{mi} \end{bmatrix} = \begin{bmatrix} -\frac{1}{T_{gui}} & -\frac{K_{gu}}{T_{gui} R_i} & 0 \\ 0 & 1 & 1 \\ \left( \frac{2}{T_{ui}} + \frac{2}{T_{gui}} \right) & \frac{2K_{gu}}{R_i T_{gui}} & -\frac{2}{T_{ui}} \end{bmatrix} \begin{bmatrix} \Delta Y_i \\ \Delta \omega_i \\ \Delta T_{mi} \end{bmatrix} + \begin{bmatrix} \frac{K_{gui}}{T_{gui}} \\ 0 \\ -\frac{2K_{gui}}{T_{gui}} \end{bmatrix} [\Delta u_{1i}]$$

$$\begin{bmatrix} \dot{\Delta Y_i} \\ \dot{\Delta \omega_i} \\ \dot{\Delta T_{mi}} \end{bmatrix} = \begin{bmatrix} -1 & -\frac{23983}{75} & 0 \\ 0,15 & 0 & 1 \\ \frac{55}{3} & \frac{47966}{75} & -5 \end{bmatrix} \begin{bmatrix} \Delta Y_i \\ \Delta \omega_i \\ \Delta T_{mi} \end{bmatrix} + \begin{bmatrix} 15,98866667 \\ 0 \\ -\frac{23983}{750} \end{bmatrix} [\Delta u_{li}]$$

$$y = Cx + Du;$$

$$y = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \Delta Y_i \\ \Delta \omega_i \\ \Delta T_{mi} \end{bmatrix};$$

## 2. Controllable, Observable, Stable (COS) [2]

Before setting the applications control on a system, the system must be ensured whether or not it can be controlled, observed, and stable.

**Controllable:**

$$P = [B : AB : A^2B]$$

$$B = \begin{bmatrix} 15,98866667 \\ 0 \\ -\frac{23983}{750} \end{bmatrix}; AB = \begin{bmatrix} -106,6 \\ -31,98 \\ 453,0122 \end{bmatrix}; A^2B = \begin{bmatrix} 10936 \\ 453 \\ -24670 \end{bmatrix}$$

$$P = \begin{bmatrix} 15,98866667 & -106,6 & 10936 \\ 0 & -31,98 & 453 \\ -\frac{23983}{750} & 453,0122 & -24670 \end{bmatrix}$$

This system can be controlled if the matrix P has rank = n. By using MATLAB, rank matrix P=3. This result shows that the system is controllable.

**Observable:**

$$P = [C^T : A^T C^T : (A^T)^2 C^T]$$

$$C^T = \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}; A^T C^T = \begin{bmatrix} -6,6667 & 18,3333 \\ -319,773 & 3639,5467 \\ 0 & -5 \end{bmatrix};$$

$$(A^T)^2 C^T = \begin{bmatrix} 44,4 & -213,9 \\ 2131,8 & -9060,2 \\ -319,8 & 664,5 \end{bmatrix}$$

$$P = \begin{bmatrix} 1 & 0 & -6,6667 & 18,3333 & 44,4 & -213,9 \\ 0 & 0 & -319,773 & 3639,5467 & 2131,8 & -9060,2 \\ 0 & 1 & 0 & -5 & -319,8 & 664,5 \end{bmatrix}$$

This system is able to be observed if the P has rank = n. The result shows that rank matrix P = 3 by using MATLAB. It means that the system is observable.

**Stable:**

The stability of system can be perceived from the Eigen values of the matrix A. The system is considered stable if the eigen values is negative. If the eigen values have imaginary components, it will produce oscillation frequency of the system. However, if the result of A matrix shows the

negative real of eigen value, it will reduce oscillations and the system will reach steady state rapidly. In contrary, if A matrix result shows real positive of eigen value then, the oscillations cannot be decreased.[3]

By using MATLAB,

eig(A)

ans =

-32.1021

2.8288

17.6066

it shows that eigen value of A matrix is on right of imaginary axis and has been changed sign from the negative to positive. It means that the system is unstable.

## 3. Linear Quadratic Programming (LQR)[1]

- Index of Performance

$$J(t_0) = \frac{1}{2} x^T(T) S(T) + \frac{1}{2} \int_{t_0}^T [x^T(t) Q x(t) + u^T(t) R u(t) dt]$$

- Assumptions:

$$S(T) \geq 0, Q \geq 0, R > 0$$

Q matrix is used to determine the value of precision control and matrix R is the cost of the controller. Q and R value will be calculated by the trial and error method to find the best settling time in the system. The simulation value of Q and R is revealed as follows:

$$\text{Exp. 1: } Q = \begin{bmatrix} 0,2 & 0 & 0 \\ 0 & 0,2 & 0 \\ 0 & 0 & 0,2 \end{bmatrix}; R = 1$$

$$\text{Exp. 2: } Q = \begin{bmatrix} 0,4 & 0 & 0 \\ 0 & 0,4 & 0 \\ 0 & 0 & 0,4 \end{bmatrix}; R = 1$$

$$\text{Exp. 3: } Q = \begin{bmatrix} 0,8 & 0 & 0 \\ 0 & 0,8 & 0 \\ 0 & 0 & 0,8 \end{bmatrix}; R = 1$$

$$\text{Exp. 4: } Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}; R = 1$$

- The optimal feedback control

$$-\dot{S} = A^T S + SA - SBR^{-1}B^T S + Q$$

- Kalman

$$K(t) = R^{-1}B^T S(t)$$

K value in this paper is obtained from the calculating simulation by using MATLAB.

- Signal control

$$U(t)^0 = -K(t)x(t)$$

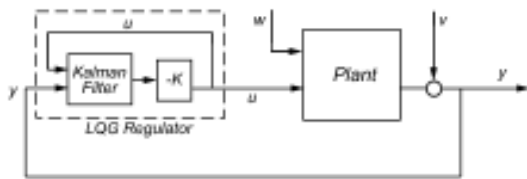


Figure 2. Blog System Diagram with LQR

MATLAB program for LQR system is showed as following below:

```
A = [-1/Tgui -Kgui/(TguiRi) 0; 0 0 1;  
      ((2/Tui)+(2/Tgui)) 2Kgui/(TguiRi) -  
      2/Tui];  
B = [Kgui/Tgui; 0; -2Kgui/Tgui];  
C = [1 0 0; 0 0 1];  
D = [0;  
      0];  
sys = ss(A,B,C,D);  
Q = [1 0 0; 0 1 0; 0 0 1];  
R = 1;  
[K] = lqr(A,B,Q,R)  
Ac = [(A-B*[K])];  
Bc = [B];  
Cc = [C];  
Dc = [D];  
sys_cl = ss(Ac,Bc,Cc,Dc)  
step(sys_cl)
```

## RESULT AND ANALYSIS

Based on the results of COS plant steam turbines above, it can be concluded:

1. The system can be controlled,
2. It can be observed
3. It is unstable.

By using LQR controller is expected to be a stable system. This can be proved by checking eigen value matrix A in the following table.

Table 1. Comparison eigen value  
with and without the LQR

Without controller	LQR Exp.1	LQR Exp.2	LQR Exp.3	LQR Exp.4
-32.10	-36,8904	-40,7222	-47,093	-49,889
2,829	-15,3390	-13,9118	-12,058	-11,396
17.61	-2,8263	-2,8237	-2,8184	-2,8158

This table shows that eigen value without controller is on the right of the imaginary axis and has been changed. It indicates that the system is unstable. After using the LQR controller, real of eigen value will change to be negative. It indicates that the system is stable and oscillations are decreased. As the result, it will be faster to get steady state.

The results of MATLAB simulation program output is written as follow:

### • Experiments without using a controller

This experiment using simulink in MATLAB can be seen in Figure 3.

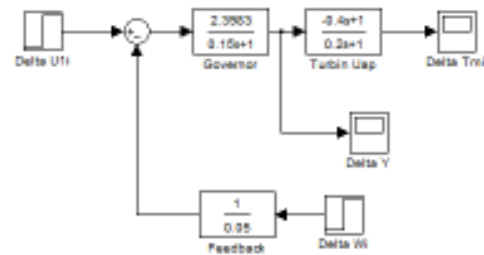


Figure 3. Block diagram open-loop simulation of the steam turbine

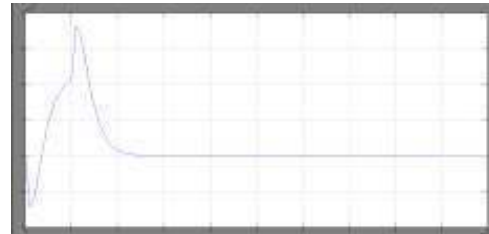


Figure 4. Response without using LQR

Based on the simulation results to reach steady state system without using LQR controller takes 2,57 seconds.

### • Experiment 1 using the LQR controller

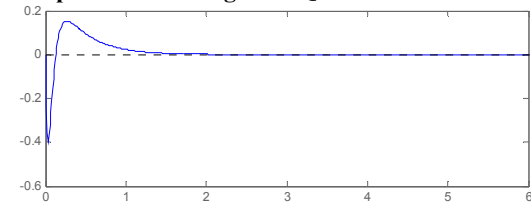


Figure 5. Response using LQR Experiment 1

Based on the simulation results of Q and R combination in Experiment 1 to reach the steady state system takes 1,81 seconds.

### • Experiment 2 using the LQR controller

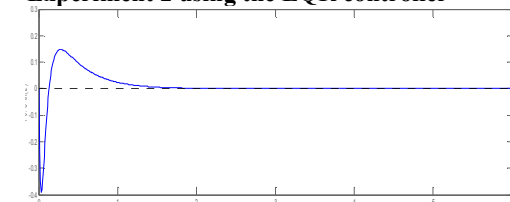


Figure 6. Response using LQR Experiment 2

Based on the simulation results of Q and R combination in Experiment 2 to reach the steady state system takes 1,82 seconds.

• **Experiment 3 using the LQR controller**

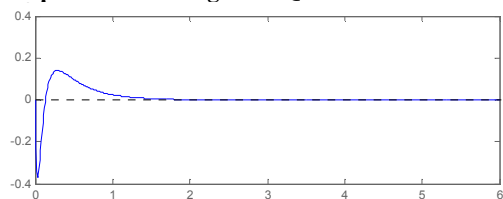


Figure 7. Response using LQR Experiment 3

Based on the simulation results of Q and R combination in Experiment 3 to reach the steady state system takes 1,97 seconds.

• **Experiment 4 using LQR controller**

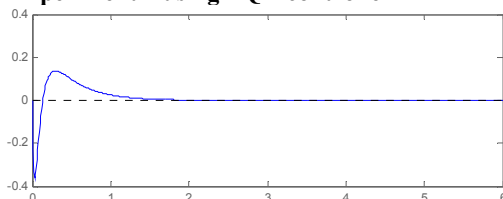


Figure 8. Response using LQR Experiment 4

Based on the simulation results of Q and R combination in Experiment 4 to reach the steady state system takes 1,98 seconds.

Table 2. Comparison of Settling Time

Tanpa Controller	LQR Exp.1 $Q = \begin{bmatrix} 0.2 & 0 & 0 \\ 0 & 0.2 & 0 \\ 0 & 0 & 0.2 \end{bmatrix}$ R=1	LQR Exp.2 $Q = \begin{bmatrix} 0.4 & 0 & 0 \\ 0 & 0.4 & 0 \\ 0 & 0 & 0.4 \end{bmatrix}$ R=1	LQR Exp.3 $Q = \begin{bmatrix} 0.8 & 0 & 0 \\ 0 & 0.8 & 0 \\ 0 & 0 & 0.8 \end{bmatrix}$ R=1	LQR Exp.4 $Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ R=1
2,57s	1,81s	1,82s	1,97s	1,98s

So the best combination of Q and R is the first experiments in which the time required to reach steady state is 1,81 seconds.

**CONCLUSION**

1. Based on the eigen value analysis, by using LQR controller, system becomes stable. LQR controller changes Eigen value from the right of the imaginary axis to be negative it indicates a stable system.
2. Response  $\Delta T_{mi}$  using LQR controller is more stable and settling time 0,76 seconds faster than without using LQR controller.
3. If Q value is changed, it will influence the time taken to get steady state and reduce oscillation.
4. The best combination of Q and R value is found

$$\text{in the 1}^{\text{st}} \text{ experiment } Q = \begin{bmatrix} 0,2 & 0 & 0 \\ 0 & 0,2 & 0 \\ 0 & 0 & 0,2 \end{bmatrix}; R = 1$$

because it has faster settling time (1,81 seconds).

**References**

- [1] Robandi Imam, "Desain Sistem Tenaga Modern", Andi Offset, Indonesia, 2006.
- [2] Robandi Imam, "Modern Power System Control", Andi Offset, Indonesia, 2009.
- [3] Sanantang, "Perbaikan Stabilitas Frekuensi dan Tegangan Beban Dinamik dengan LQR", Universitas Negeri Makassar, 2008.
- [4] Arsyat, dkk, "Perancangan Kontrol Optimal Pada sistem Multi Mechine menggunakan LQR-GSO", Universitas Diponegoro, Semarang 2013.

## IMPLEMENTATION OF ELECTRONIC LOAD CONTROLLER TO IMPROVE THE VOLTAGE QUALITY OF MICROHYDRO POWER PLANT AT BENDOSARI VILLAGE - PUJON - BATU OF EAST JAVA PROVINCE

**Rini Nur Hasanah, Teguh Utomo, and Nurussa'adah**

Electrical Engineering Department, Brawijaya University

Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Corresponding email: rini.hasanah@ub.ac.id, cell-phone:081334510268

### **Abstract**

*This article is based on the experience gotten from the community service activities carried out at the microhydro power plant (MHP) located in Tretes, Bendosari village, Pujon sub-district of the Malang regency. This MHP is functioning using a waterwheel installed on the Sewu waterfall and generating power of about  $\pm 5$  kVA. The generated power is so far utilized by the inhabitants of the Tretes village. The problems often encountered by the inhabitants served by plant was the instability of the voltage on the costumers-side when there happened some load changing. The instantaneous load removal will raise the generator output voltage which can be sensed on the user-side and could possibly damage some household electronic equipments. Therefore, an automatic redirection settings of load to a complement/dummy load on the generator side is required. If this setting is not done, a sudden increase/ decrease of load on the customer side would be followed by a sudden change in voltage on the generator, whose impact will also be felt on the customer side. This sudden change of voltage could bring about a very bad impact on the lightings and many other electronic devices (TV, radio and others). In order to maximize the benefit of the MHP for the community, a problem solution is proposed through the implementation of an electronic load controller (ELC). This controller manages an automatic load transfer to a complement load following some load removal. The use of ELC and complement/ dummy load has been proven to help in maintaining stable the generator output voltage.*

**Keywords:** microhydro power plant, dummy- load, electronic load controller

### **BACKGROUND**

Energy is one of the determining factors in economic development. Based on the data of PT PLN (Persero) APJ Malang some areas in Malang are still of very low electrification ratio.

Electrification ratio is a comparison between the number of households with electricity and the total number of households in the local area. The electricity may be supplied from the grid provided by the national electrical company or privately by many independent power producers using many kind of energy ressources. Some district areas in Malang with low electrification ratio numbers are: Wajak (52.28%), Gedangan (44.10%), Poncokusumo (57.36%), Jabung (51.95%), Sumbermanjing Wetan (50.52%), Ampelgading (62.05%) and Pujon (60.64%). As for the whole Malang regency, its electrification ratio is 72.27%.

Based on survey data in 2010, there were 926 households in the Bendosari village with the total population number of 3,783. They were living in four wide hamlets, i.e Cukal, Dadapan Wetan, Dadapan Kulon and Tretes. Among all those households, there were only 586 families who had taken the benefit of electricity (either from the national electricity grid or using solar home system/ SHS granted by the government) giving the village electrification ratio of 63.28%, far below that of the whole area Malang regency.

A survey conducted in the early of 2009 showed the feasibility of MHP development using the waterfall of Coban Sewu located at the hamlet Tretes. Its construction was realized in the same year with the support of Engineering Faculty of Brawijaya University and the funding of the Directorate of Research and Community Service (DP2M Dikti) of the Ministry of Educationa and Culture under the Technology Implementation Program, and with the participation of local village government and inhabitants. Using waterwheel system, the MHP was installed with the capacity of  $\pm 5$  kVA. The technical specifications of the waterwheel MHP plant Bendosari is shown in Table 1.

Following the lauching of the MHP plant, a problem was arising because the surrounding inhabitants could not take the benefit of the generated electricity. It had not been able to reach

the potential users/customers living around the MHP because there were no connecting electricity network available. The limited funds owned by the majority of the potential users retarded the utilization of the power plant. The problem was solved under some community service activities programs.

The quality of electricity generated by the waterwheel MHP plant Bendosari is relatively good. Based on the technical test performed by the microhydro team of the Engineering Faculty Brawijaya University in 2011, it was shown that during normal operation (no load increase/decrease on the customer-side) the value of the generated voltage was in the range of 220 volts - 230 volts (on the generation side).

If only being used for lighting load, the voltage will be very stable. Another problem showed up as the types of load were not only lighting. The sudden increase/decrease of load produced the instability of the generated voltage. So far, the plant provides electricity for around 26 customers.

The problem could ultimately bring an impact on the social-economic life of the customers community. It also deserves attention as almost all of the microhydro electricity customers are poor and potential to become the society burden, if their life quality and level are not getting improved. The voltage instability could bring about the light bulb breaking or even damage other electronic devices (TV, radio and others). This could slacken the efforts to improve the quality of life of the customers community.

Another consideration is that it is necessary to take the full benefit of the waterfall MHP plant Bendosari, as so much effort has been taken during its construction and development. It is greatly undesired to let the plant abandoned and the fund disbursed during the construction become useless.

Table I  
Power House Technical Data of  
the Waterwheel MHP Plant Bendosari

Waterwheel	Over-shoot	
	Diameter	: 2.300 mm
	Number of blades	: 18 buah
	Width of blade	: 870 mm
	Mechanical power	: 4,85 kW
Generator	Phase	: 1; 220/380 V
	Electrical power	: 2,90 kW
	Speed	: 1500 rpm
	Frequency	: 50 Hz
	Rating	: continuous
Mechanical transmission system		Axles and V-belts

This article describes some efforts done to maintain the voltage stability when there is sudden increase/decrease of the loads. One solution is realized by transferring the loading to a complement/dummy load. This mechanism can be useful to maintain almost constant the generator loading. Automatic loading transfer from the released load to the dummy load is accomplished by an electronic load controller. Other additional measures to support the implementation of ELC and dummy-load system will also be also presented, including revamping the weirs, sluiceways, networks and other loads, as well as training to educate the users and operators of the MHP plant.

Objectives of the implementation of ELC and dummy-load include two aspects, i.e. the technical aspect as well as the economic-and-social aspect. It is expected that the quality of voltage generated by the MHP plant (both under full or less than nominal loading) will be the same or at least approaching the quality of voltage provided by the national electrical company PT PLN (Persero), which is equal to 220 volts.

With the addition of Electronic Load Controller (ELC) and a dummy load system, it is desired to optimize the utilization of the electricity produced by the plant, so that it will bring a good impact to improve the community education level, environment quality, and public facilities.

It is also expected that the improvement of operators' skill and knowledge will have a positive impact, for example reducing the service unavailability and lessening the voltage drop.

Through some socialization and dissemination of standard operating and maintenance procedures as well as the "transfer of knowledge" and "transfer of technology" to the prospective managers/operators and users of the MHP plant, it is expected that the "ownership" and "sense of belonging" of the community could be kept growing.

## IMPLEMENTATION METHODOLOGY

The method used to implement the voltage quality improvement using the ELC and dummy-load system is described as follows.

A preliminary research is undertaken to pinpoint some potential problems as well as to determine the priority actions.

Based on the problems pinpointed from the preliminary survey, the solutive actions to take are in the form of "action research" which begins with the identification and analysis of problems and then being continued with a series of real actions in the



field to seek a solution with the active participation of the local population.

The ultimate goal is to maximize the existence of the MHP plant for the benefit of the surrounding villagers. It is done by the implementation of detailed engineering design to solve the problem of generation and distribution systems of electric power through the creation of an electronic load controller and a dummy-load system which is simple and easy to maintain and would maintain stable the generated voltage at about 220-volts.

The participation of the MHP operators is greatly required using the method of "learning by doing". It is purposed to involved them in the creation of the controller as well as the dummy-load system, as it is them who will always take care of the MHP plant. During this stage, they are invited to participate actively in the process of installing ELC and dummy-load system.

The stage of "learning by doing" also involves the students from the Department of Electrical Engineering Brawijaya University, as they are actively involved during the design, implementation as well as during the training to operators/users.

The adoption of continuous discussion and evaluation along the realization of the design is purposed to guarantee that the implementation of the design would follow the planning and in order that any necessary corrective actions could be taken immediately. These discussions have been carried out among the team members as well as with the users/operators, before, during, and even after the implementation process, as evaluation.

The first field activity to do is the mapping of low-voltage distribution network attached to MHP plant and also the street lightings load. It is aimed to understand the physical condition as well as the configuration of the plant load. Investigation on the field location of the plant is also to do.

The following action is to repair any perilous condition found during the mapping stage. Improvement at the field location can be in the form of reinstatement of weir of 7m length, 1m wide, and 1.5m high, and also the MHP plant sluiceway.

The next step is the design and engineering of Electronic Load Controller (ELC) and a dummy-load system. Laboratory experiment is to do before the installation at the actual field.

Preparation of Standard Operating and Maintenance Procedures as well as the training materials are required before socializing the project. Training is to undertake furthermore to prepare and educate the MHP plant operators as well as the users. It covers the training on operation and

maintenance of the plant, as well as on the electrical safety in general.

## RESULTS AND DISCUSSION

Some activity results that have been achieved in the implementation of ELC to improve the voltage quality of the waterwheel MHP plant Bendosari are outlined as following.

Some coordination and follow-up surveys have been conducted in order to pinpoint some priorities to do first. The priorities were (a). Reinstatement over the weirs and sluiceways, (b). Repairing the low-voltage distribution network and the street lightings, (c). Installation of ELC and dummy load on the MHP system.

Mapping of the low-voltage distribution network as well as of the street lightings were purposed to know the configuration and condition of the power plant load. Beside the resulted map, a grid extension as far as 7.5 kms of the low-voltage distribution network has been accomplished through some repair and installation of new power poles, as shown in Fig. 1. Fifteen points of street lightings have also been built.



Fig. 1. Maintenance of low-voltage distribution network

The next to do was improvement over the weirs and sluices. The upperpart of the weir has been reinstated by the application of some nets of dimension: 7 meters long, 1 meter wide and 1.5 meters high. Similarly, reinstatement of sluiceway has also been performed. Fig. 2 shows the condition of the weir and reinstatement done, whereas Fig. 2 shows the revamping on the sluiceway and powerhouse.



Fig. 2. Weir reinstatement



Fig. 3. Sluicagate repair and power house maintenance

The following step done was the installation of ELC and dummy-load system at the MHP plant. This activity was done with the help of some users and operators of the plant. The capacity of ELC and dummy-load system is around the same as the power plant generation capacity (3.5 kVA).

Fig. 4 shows the load panels and the 3-phase dummy-load used during the design and engineering of the ELC in the laboratory, whereas the design and testing of the ELC and the dummy-load system are shown in Fig. 5.

Panel box installation and the generator maintenance at the plant location can be seen from Fig. 6. Fig. 7 shows the installation and testing of ELC and dummy-load system at the plant location.



Fig. 4. Load panels and 3-phase dummy load



Fig. 5. Design and testing of ELC

The last activity done was giving some training about the reinstatement over the weirs and sluices; reinstatement and installation of low-voltage distribution network and street lightings; and about ELC and dummy-load system. The training process actively involved students and technicians of the Department of Electrical Engineering Brawijaya University. On the customers-side, it involved users and

operators/managers of the MHP Bendosari, so that the “transfer of knowledge” and “transfer of technology” could be attained.

## CONCLUSIONS AND PERSPECTIVES

Some conclusions that can be drawn from the implementation of ELC to improve the voltage quality at the waterwheel MHP plant Bendosari are as follows:

- With the connected loads of 26 households and 26 points of street lightings, an operational optimization of the power plant has been carried out through the implementation of ELC and dummy-load system with the capacity of at least the same as the power plant generation capacity (3.5 kVA).
- Installation of ELC and dummy-load system required also the realization of some field work including reinstatement over the weir and sluiceways as well as the work on the low-voltage distribution network and street lightings, as they relate to the operation of the plant.
- The active participation of inhabitants as well as plant operators has been achieved through the writing of a Standard Operating and Maintenance Procedure and some training on design and implementation of ELC and dummy-load system, and electrical safety.

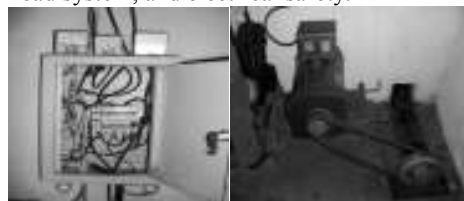


Fig. 6. Panel box installation and generator maintenance

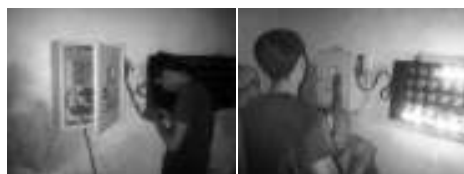


Fig. 7. Installation and testing of ELC and dummy load system

Some perspectives can also be previewed concerning the implementation of ELC to improve

the voltage quality at the waterwheel MHP plant Bendosari.

The ownership, organization as well as the management of the MHP plant Bendosari are attached to the local community, so that its existence and operational sustainability in the long term become the responsibility of the community. The users/customers must always be aware of the necessity to obey and comply with the technical and economical terms approved and stated in the collective agreement.

It is also understood that concern of the relevant institutions is required to provide any necessary technical assistance to maximize the benefit and to maintain the sustainability of the waterfall MHP plant Bendosari.

## References

- Anonym, 2002, "With the correct use, Electricity is a Good Friend", Socialization of the Law of the Republic of Indonesia No. 20 Year 2002 concerning Electrical Power, collaboration between Department of Energy East Java with the Directorate General of Electricity and Energy Development, Surabaya, 26 October 2002.
- Anonym, 2008, Small Hydropower: A Textbook Specially Designed for Training Workshop in TCTD Program, Hangzhou Regional Center for Small Hydropower, China
- Arismunandar, Wiranto, 1997. Teknik Tenaga Listrik I. Bandung: ITB Press.
- Atmel. 2006. ATmega8535/ATmega8535L, 8-bit AVR Microcontroller with 8 Kbytes in-System Programmable Flash. California: Atmel.
- Carter, Bruce and Thomas, R. Brown, 2001. Handbook of operational Amplifier Applications. Dallas: Texas Instruments
- Department of Energy and Mineral Resources, Malang Regency, 2006, "Feasibility Study of MHP Development in Malang", BPP FT UB
- Department of Energy and Mineral Resources, Malang Regency, 2006, "Detailed Engineering Design of Kali Sukun MHP in Malang Regency", BPP FT UB
- Fairchild. 2002. Application Note AN-3004: Applications of Zero Voltage crossing Optically Isolated Triac Drivers. Fairchild Semiconductor Corporation.
- Fitzgerald, A.E, Charles Kingley, Jr., and Stephen, D. Umans. 1992. Electric Machinery, 5th edition. Singapore: Mc.Graw-Hill, Inc.
- Harvey A., 2006, Micro-Hydro Design Manual: A Guide to Small-Scale Water Power Schemes, ITDG Publishing, UK
- Hasan, Achmad. "Pengontrol Beban Elektronik Pada Pembangkit Listrik Tenaga Mikrohidro." P3 Teknologi Konversi dan Konservasi Energi, Deputi Teknologi Informasi, Energi, Material dan Lingkungan, Badan Pengkajian dan Penerapan Teknologi (2006).
- Kadir, Abdul. "Pembangkit tenaga listrik." UI-Press, Universitas Indonesia, Jakarta (1996).
- Mazda, Faidoon Framroz. Power electronics handbook. Newnes, 1997.
- Mismail, B. "PLTM Sebagai Sarana Pelistrikan Desa." (1991). Pidato Ilmiah Dalam Rangka Dies Natalis Unibraw, Malang, Universitas Brawijaya.
- Mismail, Budiono. Pelistrikan desa di Indonesia. Lembaga Penerbitan, Universitas Brawijaya, 19, 1982.
- Monition, le Nir. "Roux." Micro Hydroelectric Power Stations," John Wiley and Sons, Paris (1984).
- Pabla, A. S., and Abdul Hadi. "Sistem Distribusi Daya Listrik." Erlangga, Jakarta (1994): 181.
- Rashid, Muhammad H., ed. Power electronics handbook. Academic Pr, 2001.
- Santoso H., Hasanah R.N., Utomo T., 2009, "Pembangunan Pembangkit Listrik Mikrohidro (PLTMH) Kincir Air: Upaya Penyediaan Energi Listrik di Perdesaan Menuju Desa Mandiri Energi", Program Penerapan Ipteks DIKTI – LPPM Unibraw di Desa Bendosari Pujon Kab. Malang
- Santoso H., Hasanah R.N., Utomo T., 2008, Studi Potensi Pembangkit Listrik Tenaga Mikrohidro (PLTMH) di Wilayah Malang Raya, Penelitian Dana DIPA FT UB - Tahun 2008
- Shidiq M., Utomo T., Dachlan H.S., 2007, Perbaikan Manajemen dan Keselamatan Ketenagalistrikan Pada Pembangkit Listrik Tenaga Mikrohidro (PLTMH): Upaya Peningkatan Kualitas dan Kuantitas Industri Listrik Mikrohidro di Perdesaan, Program Penerapan Ipteks Dikti, Depdiknas – LPM Unibraw
- Sunarto E., 1995, "Serbaneka Penerapan PLTMH", Seminar Nasional Pengembangan IPTEKS Bidang Teknik Elektro dan Peningkatan Pemanfaatan Sumber Daya Alam Untuk Pembangunan Perdesaan, Malang, Fakultas Teknik Universitas Brawijaya.
- Utomo T., Hasanah R.N., Djakfar L., Pramono S.H., 2011, IBM Calon Pelanggan PLTMH

- Bendosari, Program Pengabdian Kepada Masyarakat, FT UB
- Utomo T., Santoso H., Hasanah R.N., 2008, Kaji Tindak Perbaikan Kualitas dan Kuantitas Listrik Mikrohidro (PLTMH) Check Dam V Kalijari Dusun Jari Sukomulyo Kabupaten Blitar, Program Penerapan Vucer DIKTI – LPPM Unibraw
- Utomo T., Dachlan H.S., 2005, “Pembentukan Koperasi Listrik Perdesaan Sebagai Wadah Pengelolaan Industri Listrik Mikrohidro di Perdesaan”, Program Penerapan Ipteks DIKTI – LPM Unibraw
- Warnick C.C., 1984, Hydropower Engineering, Prentice-Hall, Inc, Englewood Cliffs, New York.

## HYBRID POWER PLANT FEASIBILITY STUDY IN MANDANGIN ISLAND USING HOMER SOFTWARE

Soeprapto<sup>1</sup>, Mahfudz Shidiq<sup>2</sup>, Unggul Wibawa<sup>3</sup>

<sup>1,2,3</sup> Department of Electrical Engineering

Faculty of Engineering, Brawijaya University, Malang, Indonesia

### Abstract

In this research, a feasibility study of Diesel Power Plant existing on the island Mandangin with hybrid using Renewable Energy (RE) in the form of photovoltaic (PV). HOMER is an optimization analysis software for power system design, seen from the value of the Net Present Cost (NPC) the lowest. HOMER itself is an abbreviation of Hybrid Optimization Model for Electric Renewable developed by the National Renewable Energy Laboratory (NREL) USA. The system design is based on data obtained from diesel Mandangin Island. Of the total power of 1500 kW capable resurrected, but only used 400 kW. For design optimization is done by adding the PV system as a source of renewable energy of 300 kW. Analysis of the resulting HOMER, a design created to meet the needs of 100% load with the excess energy of 0.01%. Hybrid system configuration that has made the high initial cost, but the total NPC generated was reduced by \$ 4,948,556. For the amount of fuel used, Hybrid system uses less fuel amount to a reduction of 184 565 L/year or a total of \$ 180.931 per year compared with the existing diesel system. The amount of emissions released Hybrid system was also decreased with decrease of 486.123 kg/yr of CO<sub>2</sub> and 1,200 kg/yr for CO. In conclusion, HOMER is software that can optimize power generation.

**Keywords:** *diesel, photo voltaic, hybrid system, HOMER*

### BACKGROUND

Soelaiman (1995) divides the energy resources into three (3) major categories namely energy resources from air, land resources of energy and energy resources of the oceans. Energy resource from air is solar energy that gives life to all beings on this earth. According Bansai, N.K. (1995), in the hybrid system of diesel generators is a mandatory component to be incorporated in the system to generate power during periods where solar radiation is very low or none at all, to supply the peak load as well as to reduce the size of the array and battery bank. Joseph N.W. (1998), illustrates the layout of

the PV hybrid system - Diesel which shows the flow of energy that is expected when the PV hybrid system - Diesel is operating. However, inverters and battery charge has the direction of the arrow which indicates that the energy will flow from these two directions. This is because they are able to operate as an inverter and supply power to the load and charge the battery. Battery banks on the other hand will supply energy to the load as long as there is energy from the PV array or a diesel generator. Wachjoe, C.K. (1999) states, that the power plant with a hybrid system is a system that utilizes alloy renewable energy sources such as wind energy technologies, PV, micro-hydro, biomass, and other renewable energy sources. Based Fitriana, Ira (2003), PV-diesel hybrid systems can be classified into three configurations, namely: (a) Hybrid System Series (b) Hybrid Systems Switched and (c) Parallel Hybrid System. A. Pansini J. (1986) before determining the type and size of the components of the system then we should be able to know and predict the future load growth. These data will be used to determine the daily energy needs.

Mandangin Island is one of the villages located in the district of Sampang and is located 15 Km South from Sampang city. The island Mandangin about 1.65 km<sup>2</sup> elliptical shaped cross-section with the center line, approximately 1,800 m long and 800 m wide. Mandangin Island consists of three hamlets namely West Hamlet, Hamlet Kramat (Central Gili) and Hamlet Candin (Gili East). For availability of electricity, the island has a diesel Mandangin managed by PLN with a total power of 1500 kW can be generated, but used only 400 kW. One of the factors that lead to high costs of operation and maintenance of Diesel Off-Grid Power Plant are currently widely applied in remote areas because the diesel can not operate optimally, so also are found on the island Mandangin.

One reason is the magnitude of the difference between the base load (base load) that usually occurs in the morning - and afternoon peak load (peak load) that occurs at night. In remote areas

there are generally loads the burden of housing / residential so the loading pattern is usually a 12-hour load pattern. In the conventional system which uses only electrical energy supply of diesel, the diesel if they are operated on the base so that the load operation will be inefficient diesel because diesel has a maximum working load capacity when only 80%-90% of the rated capacity (rated capacity). The impact of these operations cause inefficient operation and maintenance costs for diesel will be increased, especially the cost of fuel. Therefore, to reduce the use of diesel fuel so that the performance of diesel can be increased is by changing the operational pattern of diesel into a single diesel hybrid power plant (Hybrid Diesel – Solar).

Modeling using the computer software is an option that can facilitate the analysis of the desired system. This study using HOMER software as a software for designing and optimizing its systems PLH berdasarkan economic terms, such as start-up costs, operating costs and maintenance (O & M) and the net present cost (NPC). While environmental aspects are optimized gas emissions released system, either in the form of CO<sub>2</sub>, CO and others. HOMER makes use of the feasibility study to be more effective and efficient by including all factors into system design.

The purpose of this study was to determine the performance of a diesel hybrid systems-solar Mandangin Island based technical, economical and environment with the help of software Homer. The benefits of this study include: (1) reduce costs of diesel consumption, also plant operating costs, (2) development the use of renewable energy sources, (3) supports energy and environmental conservation. Globally, through the operation of diesel fuel combustion will clearly have a negative impact on the environment. Environmental impacts caused by the operation of the diesel fuel through the combustion is CO<sub>2</sub> emissions. CO<sub>2</sub> emissions will lead to greater global warming, where the earth's temperature will be higher and will eventually Earth's climate changes

## METHODE

Preliminary studies that have been carried out by Teguh Utomo (2005) on plant more hybrid diesel examine single loading pattern with the pattern of operation 12 hours or 24 hours. Results of preliminary studies that have been conducted that show the comparison between the daily load characteristics supplied by a single diesel and PV hybrid power supply system - diesel for operating patterns 12 hours and 24 hours imposed.

Preliminary studies conducted by Teguh Utomo (2005), also showed how much the amount of electrical energy that is wasted in the operation of diesel power systems for 12 hours and 24 hours. At low load, the energy supply is only generated by solar energy through the battery and inverter. System battery is used to store electrical energy generated by solar power or diesel. Inverter which in this case is "bi-directional" function to change the energy source of DC power to AC or vice versa. When the load increases where solar power systems, batteries and inverters no longer able to distribute the load, the diesel operates optimally to meet the load demand with the excess energy is used to charge the batteries through an inverter which in this case serves as a "rectifier" or "charger". If the load continues to increase so that the capacity of the inverter or diesel capacity is not enough to distribute the load, the diesel and the inverter can operate in parallel so that the hybrid system operates with a capacity of diesel capacity plus the capacity of the battery current is converted by an inverter.

HOMER is a micro power models to facilitate in evaluating the design of a single network (off-grid) or network connected systems (grid-connected). In designing the system to be aware of the power system configuration, including: any component that cannot be included in the system configuration, how many and what size of each component to be used, the number of technology options in the calculation of the cost and availability of existing energy resources such as shown in figure below.

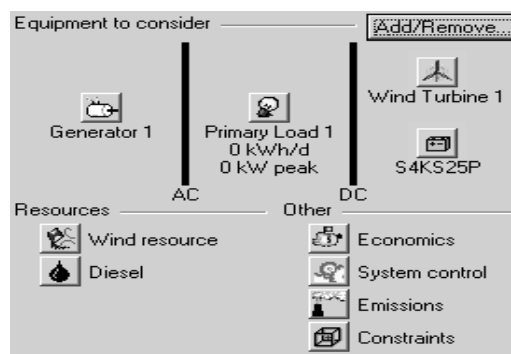


Figure 1. Homer Configuration

Stages of this research include: (1) A literature review to assess the potential theoretically diesel hybrid energy resources - solar for power generation is done through books, journals and other literature that support the research, (2) determination of the location of the study, namely Mandangin archipelago, Sampang, East Java, (3)

taking primary data, such as power and energy measurement load, as well as some secondary data from Monograph Village and PT. PLN (Persero), (4) Analysis of data consists of: technical, economical and environment analysis.

## RESULT AND DISCUSSION

### Electrical System and Load Conditions

Figure 2 below shows the load profile Mandangin island, with a peak load reaches 537 kW and 220 kW lowest load.

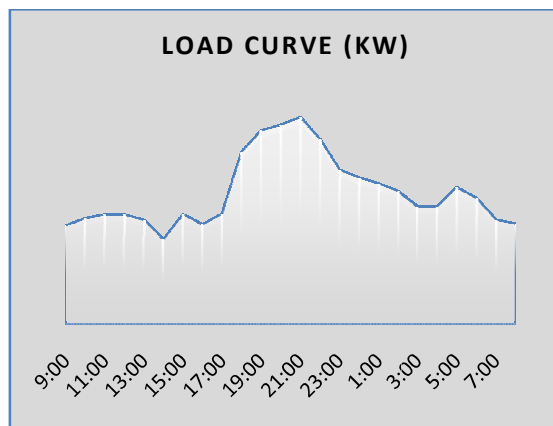


Figure 2. Load Profile Mandangin Island

In this study, conducted primary data collection for solar radiation. The data have been obtained are also compared with data taken from the website by entering the coordinates eosweb.larc.nasa.gov desired region. Mandangin Island lies at 7° 18' 37.63" South and 113° 12' 44.93" East. For data retrieval is done manually, using gauges solar radiation, solar meter.

Figure 3 below shows the pattern of solar radiation on the island Mandangin. The total annual radiation ranged 65.39 kWh/m<sup>2</sup>. The highest radiation 6.86 kWh/m<sup>2</sup> occurred in April and lowest in December terjadi pada 4.13 kWh/m<sup>2</sup>.

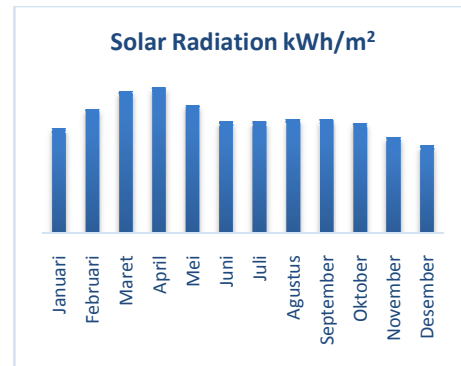


Figure 3. Solar Radiation Data Mandangin Island

### Pattern Design and Results of Operations

Based on daily load data were simulated on the system configuration and the generation pattern mengambil example in one month (January), then produce a pattern of daily operations of each unit.



Figure 4. HOMER Simulation Optimization Results

### Pattern Design 1

Pattern 1 is a pattern operating system operations that lasted from 0600 until 18:00. The figures (kW) that accompany the figure-5 below, stating the power generation/load at 12.00 hours.

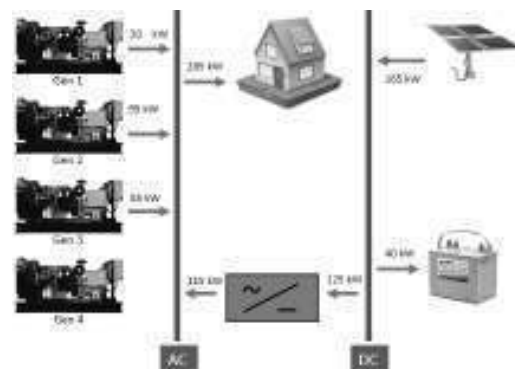


Figure 5. Pattern Design 1

Seen first operation pattern, ie when the load is supplied by renewable energy (ET) in the form of PV and assisted by three generators, generator 1,

generator 2, generator 3. While the battery when it is in the charging position.

### Pattern Design 2

Second operating pattern is the pattern continued operation of the first operation pattern, which is located at 18.00 s / d 23:00 or in other words, the operation pattern refers to the peak load of the load curve. The figures shown in the picture-6, shows the power generation at 21.00.

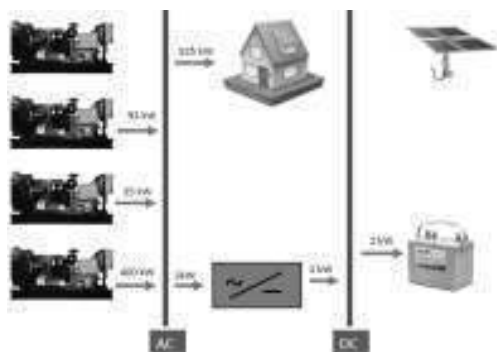


Figure 6. Pattern Design 2

Figure-6 above, shows a different pattern of operation, to the pattern of this second operation in which the sun had set, then PV is clearly no longer in operation. Thus it is seen that the generator 4 which has a capacity of 400 kW to work, aided by the generator 2 and generator 3 that's enough to carry peak loads. In this operating pattern they started to operate in a state of the battery is still charging even though the battery power is going to be relatively small compared with the first operation pattern.

### Pattern Design 3

Pattern 3 operation is the last operation of the pole can be inferred from the existing generation curve. This pattern tends to lie in the middle of the night until sunrise, which is located at 23.00 to 06.00. Figure-7 shows the pattern of operation which is located at 03.00.

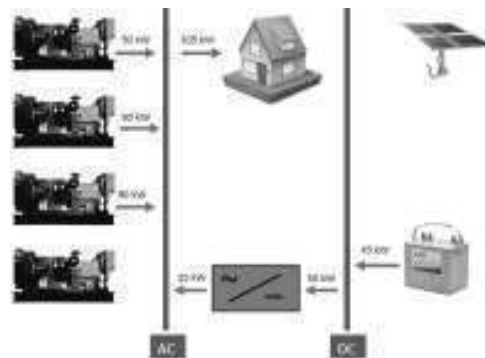


Figure 7. Pattern Design 3

From Figure-7 clearly visible patterns involving battery operation as a source of power generation. Assisted with 2 generators, generators 3 and 4 generators as a source of energy. For generators 4, does not operate due to other generators and the battery is sufficient to supply the load. PV is not operating because the sun does not exist for the moment.

### Electrical Analysis

In this analysis, the use of visible role for each component installed on the configuration inputted it into the HOMER software in terms of the contribution of energy supply. Figure 8 below shows the role of each component installed.

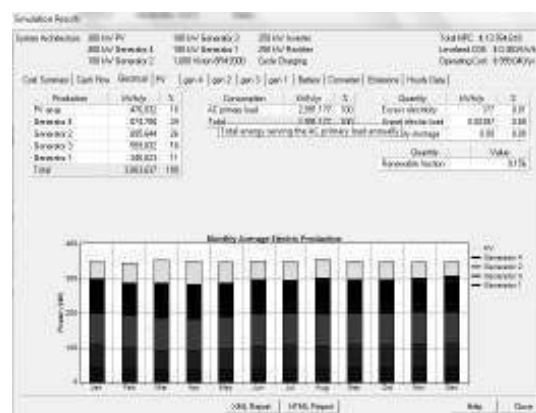


Figure 8. Performance Energy Sources

From these data we see that the role of ET here is able to meet the load requirement of 16% per year, due to the obvious role of PV here is only available during the daytime when exposed to solar radiation alone. And if you look at the column of excess electricity or energy excess seen only by 0.01% or as much as 177 kWh / yr which is where the configuration of the system is very effective.



## Economic Analysis

Economic analysis refers to how the cost of installation, NPC (Net Present Cost) and how much it costs to supply diesel fuel for the purpose of this study refers to the policy itself PLN to save fuel from year to year more and more expensive while the dwindling availability.

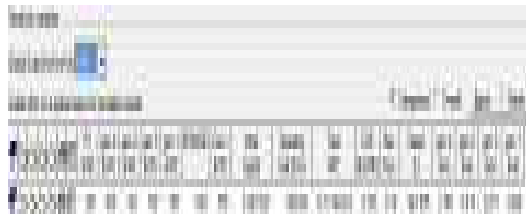


Figure 9. The results of the Hybrid System Configuration



Figure 10. The results of the Diesel System Configuration

From Figure 9 and Figure 10 shows that the EE system can save fuel consumption Bahan around \$ 180.931 per year and fuel usage of 184,565 L / year.

From the comparison of the two images above, also showed differences in the total NPC obtained. This NPC is calculated based on the total cost incurred during the calculation of 25 years. For EE configuration, obtained a total of \$ 13,764,624 NPC, while the diesel configuration obtained for a total of \$ 18,713,180 NPC. Although EE configuration sitem initial cost of \$ 77.721. For PV installation at a cost of \$ 44.589, the converter at a cost of \$ 1.841 and a battery at a cost of \$ 31.291 per year for a total of \$ 993.529 for 25 years.

## Environment Analysis

In this discussion, compared to two system configurations to determine the differences and changes that occur when RE is used on the system configuration Hybrid system.



Figure 11. Emission System Simulation Results of Hybrid System



Figure 12. Emission System Simulation Results of Diesel System

From Figure 11 and 12 it can be seen the role of ET in the HLM system is able to parse the configuration of carbon dioxide (CO<sub>2</sub>) which dikerluarkan of 486.123 kg/yr, and the very large number if calculated from diesel emissions that have previously been operating for many years. And the role of ET is able to reduce the amount of carbon monoxide (CO) emitted from diesel configuration of 1,200 kg/yr.

Due to the amount of state standard atmospheric carbon monoxide (CO) in the air is only about 0.1 ppm, in relation to the emissions released by diesel then it would be very dangerous if not maintained. And for carbon dioxide itself, if not actually at the press of expenses, then the amount in the atmosphere will be more and more and more ozone damage, in other words, will cause the greenhouse effect on the ozone. In addition to damaging human health, such as skin cancer, it is also very harmful to the environment. The greenhouse effect due to the increasing amount of carbon dioxide (CO<sub>2</sub>) can raise the temperature of the earth and the most severe in the polar ice will melt in the long run. Therefore, the use of ET especially in the form of PV would be very useful to reduce environmental damage generated by diesel emissions.

## Conclusion

From the simulation results based on desired system configuration EE, it was concluded regarding electricity, economics, and the environment as follows below: (1) Mandangin Island has diesel power systems that tend to be inefficient, (2 ) Island Mandangin have renewable energy sources, especially solar, which can be

utilized as a source of energy for areas that do not receive the electrification of PLN. (3) Environmental Management System which includes 4 diesel generator set PLN, photovoltaics, battery and converter. (4) Environmental Management System that is determined to meet the needs of 100 % load with excess electricity (excess energy) of 0.01 %. (5) From the EE system is specified, the contribution of renewable energy that is channeled through the photovoltaic able to meet the load requirement of 16% of the total load required. (6) Optimization of system optimization PLH compared to existing diesel generating NPC total decrease of \$ 4,948,556 and a decrease in fuel usage of 184,565 L/year, or a decrease of \$ 180.931 per year. (7) In terms of emissions, Environmental Management systems tend to be more in the form of carbon dioxide emissions (CO<sub>2</sub>) and carbon monoxide (CO) is less than the existing diesel system configuration with a decrease of 486.123 kg/yr of CO<sub>2</sub> and 1,200 kg/yr of CO.

## Reference

- Abdul Kadir (1990), *Energy*, Jakarta, Universitas Indonesia.
- Abdul Kadir (1996), *Pembangkit Tenaga Listrik*, Jakarta, Universitas Indonesia
- Ajan, C. W., Shahnawaz Ahmed, S., Ahmad, H. B., Taha, F. & Mohd Zin, A. A. B. (2003), 'On the policy of photovoltaic and diesel generation mix for an off-grid site: East Malaysian perspectives', *Solar Energy*, vol. 74, no. 6, pp. 453-467.
- AS Pabla. (1995). *Sistem Distribusi Daya Listrik*. Erlangga. Jakarta
- Bansai, N.K. (1995), *Renewable Energy Sources and Conversion Technology*, New Delhi, Tata McGraw-Hill Publishing Company Limited.
- Basri, Hasan. (1997). *Sistem Distribusi daya Listrik*. ISTN. Jakarta.
- BPP Teknologi. (1999). *Report on Technical Evaluation of Subang Hybrid Systems*. Jakarta.
- Boyle, Godfrey (1996), *Renewable Energy Power for Sustainable Future*, New York, Oxford University Press in Association with the Open University.
- Didik Notosudjono, (2003), *Prospek Pengembangan dan Implementasi Energi Terbarukan Bagi Sektor Kelistrikan di Indonesia*, Seminar Nasional Jurusan Teknik Elektro FT Unibraw, 05 April 2003.
- Dubey, Gopal.k. (1989). *Power Semiconductor Controlled Drives*. Prentice Hall: International Edition.
- Fitriana, Ira. (2003). *Sustainable Energy Systems and Management (SESAM)*, MSc. Thesis. University of Flensburg. Flensburg
- Houghton, J.T., Filho, L.G. Meira, et al (1997), *Greenhouse Gas Inventory Workbook*, United Kingdom.
- Joseph N.W. (1998). *An Interactive Menu-Driven Design Tool For Stand- Alone Photovoltaic Systems*. Virginia Polytechnic Institute and State University Thesis. Blacksburg.
- Kusko, Alexander. (1989). *Emergency/ Standby Power Systems*, McGraw Hill Publishing Company. Newyork.
- Marini Simarankir, Susi. (2003). *Load Management in Dewata Tea Estate(Indonesia) in Relation To The Capacity of the New Mini Hidro and the Existing Diesel Generator*. MSc. Thesis in Energy System and Management. University of Flensburg. Flensburg.
- Pansini, Anthony J. EE. PE. (1986). *Electrical Distribution Engineering*. B & JO Enterprise Pte. Ltd. Singapore.
- Rashid, M.H. (1993). *Power Electronic: Control, Devices and Applications*. Prentice- Hall : International Edition.
- Soelaiman, T.M. (1995), *Pengembangan Iptek Dalam Bidang Teknik Elektro dan Peningkatan Pemanfaatan Sumber Daya Alam Untuk Pembangunan Perdesaan*, Malang, Seminar Nasional Jurusan Teknik Elektro FT Unibraw, 27 Mei 1995.
- Skrotzki. Bernhardt G.A.,M.E.,B.S.E.E. (1990). *Power Station Engineering and Economy*. Tata McGraw-Hill Company Ltd. New Delhi.
- Teguh Utomo, dkk (2005), *Studi Kelayakan Pembangkit Energi Terbarukan*, Kerjasama PT PLN (Persero) – BPP FT Unibraw
- Wachjoe, C.K. (1999). *Pengembangan Sistem Iibrida Untuk Mendukung Kelistrikan di Indonesia, Presentasi Energi Baru Dan Terbarukan Di Indonesia*. Jakarta.
- <http://www.aes.ltd>. *The Static Power Pack*. Advanced Energy Systems Limited. Bentley.
- <http://www.aes.ltd>. *Hybrid Systems Overview*. Advanced Energy Systems Limited. Bentley.
- <http://www.infinitepower.org>. *Introduction to Photovoltaic Systems*. Rene Energy The Infinite Power of Texas. Texas
- [http://www.bbc.co.uk/weather/world/city\\_guides/city.shtml](http://www.bbc.co.uk/weather/world/city_guides/city.shtml).
- <http://www.solarserver.de>.
- [http://www.risoe.dk/konferencer/energyconf/presentations/afrane\\_okese.pdf](http://www.risoe.dk/konferencer/energyconf/presentations/afrane_okese.pdf).

## APPLICATION OF COAL GASIFICATION AS SOURCE OF FUEL IN THE CARBONATION PROCESS OF LOCAL KOKAS BRIQUETE.

Wijianto<sup>1</sup>, Subroto<sup>2</sup>), Dwi Aries Himawanto<sup>3</sup>)

<sup>1,2</sup>)Jurusan Teknik Mesin

Fakultas Teknik Universitas Muhammadiyah Surakarta

Jalan A. Yani Tromol Pos 1 Kartasura Sukoharjo

<sup>3</sup>)Jurusan Teknik Mesin

Fakultas Teknik Universitas Sebelas Maret

Jalan Ir. Sutami no. 36A Surakarta

<sup>1</sup>)e-mail : wijianto@ums.ac.id

### Abstract

*The main objective of this research is applying the heat generated from the combustion of coal gasification for carbonation process of local kokas-briquettes.*

*The research was started from collecting of raw materials which has a low calorific value. Firstly, drying coal to make a maximum moisture content of 12 % and form the coal at size of 10 cm. Next process is filling the vertical downdraft gasifier with 6 kg of coal, burn with LPG gasses as ignier, turn on the blower to the maximum speed in order to start combustion process. After that, all coal in the surface of gasifier have been burned, attach the burner and then count the velocity of air that is produced by blower as parameters to find the optimal velocity in order to get the perfect combustion.*

*The result showed that the coal gasification technology with vertical downdraft gasifier system have the prospect to be developed as a source of heat in the process of carbonation of local coal briquettes. Using 6 kg of coal gasification can produce temperature at furnace carbonation around 170 °C as long as 60 min with local kokas-briquettes that are carbonated at 10 kg.*

**Keywords:** local kokas briquettes, gasification, vertical downdraft gasifier, coal

### INTRODUCTION

Kokas briquettes are an important component as fuel to metal melting in the metal casting process that uses cupola system. Mechanical strength and good capability to burn of briquettes is a parameter that determines the success of the metal melting process.

Optimization of strength of mechanical and characteristics of kokas briquettes are determined by several factors, for example operating conditions

of the kokas briquettes. In the carbonation process of the volatile content of kokas briquettes will be minimized in order to strengthen the bond of briquettes. Carbonation is one of the important processes in the manufacture of briquettes, but this process also need high cost, because the heat required in the process of carbonation is quite high and always continuously. On the other hand, businessmen always want production of kokas briquette at low cost, so more competitive when it is compared with use electricity. Therefore alternative heat source is needed in the process of carbonation. Hot Gasses that come from the combustion of coal on gasification process is one of the alternatives, because the price of coal is quite low, around Rp. 1000.00/kg and have high calorific values.

Gasification is as the process of thermo-chemical conversion of solid-biomass materials into gasses, such as carbon monoxide, hydrogen, methane, carbon dioxide, and water vapor. Research about gasification have been carried such as Reed et al (2000) examined the issue of engineered wood furnace modified with gasification systems, and found that the addition of the blower with the power of 3 W is able to produce 1-3 kW of power (heat) that can be used to cook with efficiency over 30%. Dassapa and Paul (2001) conducted research on coal gasification in packed bed and showed that many occur during the heat loss, cooling conditions and found that the critical air flow rate to produce charcoal flame propagation within the maximum range at 0.1 kg/m<sup>2</sup>s. Kramreiler et al. (2008) examined the problem gasification of biomass to produce power 125 kW biomass gasification find that the pace is determined by the biomass particle size, moisture content of the biomass and the dominant factor to improve the efficiency of gasification is a variation of the air flow rate. Pathak et al. (2008) examined

the performer evaluation of down draft gasifier types of agricultural waste-fueled, it was found that to improve the conversion of larger gasification at high temperatures required greater air flow.

In this paper, we will describe the application process of coal gasification to make a carbonation of local kokas briquettes.

## RESEARCH METHODOLOGY

### Material

This Gasification process uses coal which has a low calorific value that is equal to 4253.03 cal/g



(a)

with an average particle size of 10 cm. As for the local carbonated kokas briquettes are local kokas briquettes that are produced by a previous research of the research team.

### Equipment

This research uses a vertical down draft gasifier type in 15 cm diameter, outer diameter of 20 cm and a height of reactor is 60 cm, as shown in Figure 1.a. Figure 1.b is a furnace where the process of carbonation of local kokas coke briquettes occurs with a carbonation furnace capacity equal to 10 kg.



(b)

Figure 1. (a) Vertical Downdraft Gasifier (b) Furnace

### Collecting the Data Method

Research is started with the collection of raw material such as coal and local kokas briquettes according to the results of previous research. Coal is dried to achieve maximum moisture content of 12 %, and make size of coal in average size of 10 cm. Gasifier tube is filled with coal until full, startup process with LPG gas as an Igniter, then turn on blower at top speed and igniter is turned in order to combustion process occurs, after all coal on the surface of gasifier is burned, burner immediately mounted and lighted in order to rise up a flame. Meanwhile, in the gasification furnace filled with local kokas briquettes with weight 10 kg. The data from this research are the temperature distribution

in the furnace of gasifier tube, which is at the bottom of a pile of local kokas briquettes, in the middle and in the upper of the local kokas briquettes. Air velocity in this gasification system is 6 m/s.

## RESULT AND DISCUSSION

Figure 2 presents the graphs relationship between the temperature of the flame produced in the coal gasification process with air velocity on the gasification process at 6 m/s. In the picture, it appears that the greater speed of the maximum flame temperature generated is capable of 450°C, but averages of the temperature of the flame is of 300°C.

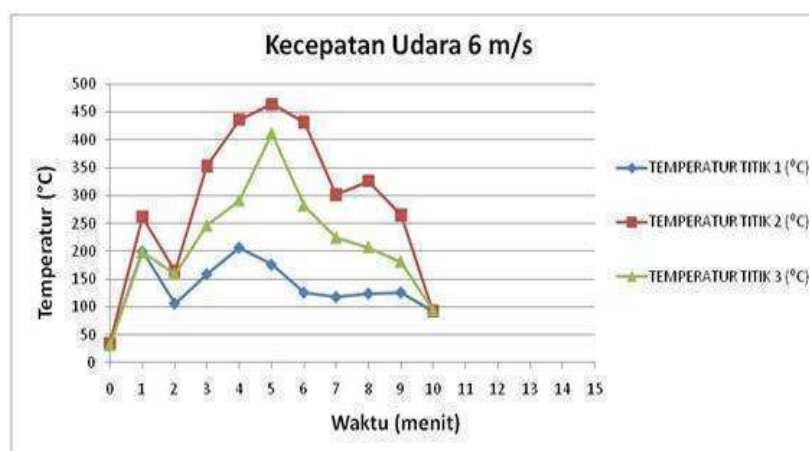


Figure 2. Characteristics of coal gasification in air velocity 6 m/s.

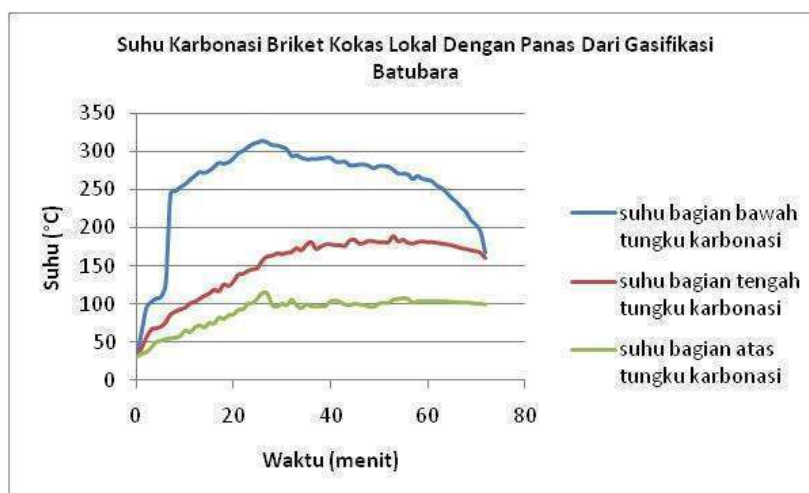


Figure 3. Temperature distribution in the furnace of carbonation of local kokas briquettes

Figure 3 shows the temperature in the centre of gasification-furnace of local kokas briquettes around 175 °C, and it is quite a big different when compared with the lower part of the furnace which can reach 275 °C. That is because the direction of the fire resulting from the combustion gases of coal gasification is in the horizontal direction so that wasted a lot of heat to the environment, so it needs a steering flame in order the heat can be focus in the gasification-furnace. From the research, it appears that the coal gasification process can be used as a source of heat in the carbonation process of local kokas briquettes, although it still requires further research, especially in terms design of space ignition in the furnace carbonation.

## CONCLUSION

The result show that the coal gasification technology with vertical downdraft gasifier system have the prospect to be developed as a source of heat in the process of carbonation of local kokas briquettes, which with 6 kg of coal gasification temperature in the furnace can be produce an average carbonation 170 °C for 40 min. Heavy local kokas briquettes are carbonated at 10 kg.

## ACKNOWLEDGEMENTS

Author would like to thank to DP2M Directorate General of Higher Education Ministry for the implementation of these activities through Hi Links at fiscal year 2010.

## References

- Bateman, K.J., Germane, G.J., Smoot, L.D., Blackham, A.U., Eatough, C.N., 1994. *Effect of Pressure on Oxidation rate of Millimetre-Zised Char Particles*, Brigham Young University, Provo, USA.
- Belonio, A. T., 2005, *Rice Husk Gas Stove Handbook*, Department of Agricultural Engineering and Environmental Management College of Agriculture, Central Philippine University, Iloilo City Philippines.
- Blackham, A.U., Smoot, L.D., Yousefi, P., 1993. *Rates of Oxidation of Millimetre-Zised Char Particle : Simple Experiment*, Brigham Young University, Provo, USA.
- Borman, G.L., Ragland, K.W., 1998. *Combustion Engineering*, Mc Graw Hill Publishing Co, New York.
- Campbell, P.E., 2005. *Advanced Combustion and Gasification of Fuel Blends*, Northern Ireland Centre for Energy Research and Technology.
- Dassapa, S., Paul, P.J., 2001, *Gasification of Char Particle Beds : Analysis and Results*, Int.J.Eng.Res. 25, pp. 1053-1072.
- Hase, K., Kori, Y., Ohgi, K., 1991, *Effect of The Air/Fuel Ratio Fluctuation on The Formation of Nitrogen Oxides*, Proceedings of the First International Conference, Vilamoura, Portugal, September 3-5, 1991.
- Ito, Kenichi., Balingcongan, Romeo M., Fujita, Osamu., 1991, *Flameless Combustion of Premixed Gas Within Porous Radiant Burners using a Ceramic Fiber Mat as Burner Material*, Proceedings of the First International Conference, Vilamoura, Portugal, September 3-5, 1991.
- Ismail, S., 1992. *Beberapa Alternatif Pemanfaatan Batubara Indonesia Sebagai Usaha Diversifikasi Sumber Energi Primer*, Loka Karya Energi. Pertamina-Komite Nasional Indonesia-World Energy Council, Jakarta.
- Kerampran, S., Desbordes, D., Veyssiere B., 2000, *Study of The Mechanisms of Flame Acceleration in a Tube of Constant Cross Section*, Combust. Sci and Tech, Vol. 158, pp. 71-91.
- Kramreiler, R., Url, M., Kotik, J., Hofbauer, H., 2008, *Experimental Investigation of a 125 kW twin-fire Fixed Bed Gasification, Pilot Plant and Comparison to The Results of a 2 MW Combined Heat and Power Plant (CHP)*, Fuel Processing Technology 89, pp. 90-102.
- Pathak, B.S., Pakel, S.R., Bhave, A.G., Bhoi, P.R., Sharma, A.M., Shah, N.P., 2008, *Performance Evaluation of An Agricultural Residue Based Modular Throat-type Down Draft Gasifier for Thermal Application*, Biomass and Bioenergy 32, pp. 72-77.
- Prasetyo, Totok., Effendy, Marwan., 2003, *Formulasi Tinggi Nyala Bahan Bakar LPG Di Daerah Stabilitas Nyala*, Jurnal Teknik Gelagar, Vol. 14 No. 01, hal. 73-79.
- Reed, T.B., Anselmo, E., Kircher, 2000, *Testing and Modelling The Wood-Gas Turbo Stove*, Progress in Thermochemical Biomassa Conversion Conference, September 17-22, Tyrol, Austria.
- Soedjoko, T.S., Susilo, W., 1988. *Briket Batubara Untuk Keperluan Industri Kecil*, Hasil-hasil Loka Karya Energi 9-10 Agustus 1988, Pertamina-Komite Nasional Indonesia-World Energy Council, Jakarta.
- Sudarno, 2005, *Pengaruh baris Sirip Pada Reflektor Radiasi Panas Terhadap peningkatan Efisiensi Kompor Minyak Tanah Bersumbu*, Seminar Nasional T. Elektro UMY, Juli 2005.

## GOVERNOR CONTROL MODEL DESIGN USING PID CONTROLLER IN STEAM POWER PLANT

Aji Akbar Firdaus<sup>1)</sup>, Ribka Stephani<sup>2)</sup>, Hidayatul Nurohmah<sup>3)</sup>,  
Nita Indriani. P<sup>4)</sup>, Imam Robandi<sup>5)</sup>

<sup>1,4,5)</sup> Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember Surabaya

<sup>2)</sup> Universitas Kristen Petra, Surabaya

<sup>3)</sup> Universitas Darul Ulum, Jombang

### Abstract

*The electrical system must be able to provide electricity to customers with a constant frequency. The frequency of the system depends on the active power balance. Active power balance is affected by the active power demand by customers. Changes in active power demand by the customer will result in a change in system frequency. So to maintain the nominal frequency so as not to exceed the tolerance allowed the provision of reactive power must comply with the requirements. Active power supply arrangement is done by adjusting the amount of mechanical coupling is necessary to turn a generator. In this case the provision is set on a gas turbine fuel.*

*A governor on each generator unit serves as the primary regulator or fuel vapor giving the generating units. With the change of the load then the governor should be able to maintain order issued by the generator frequency is constant and does not exceed a predetermined tolerance. Due to changes in the load it will need a controller that has a fast and stable response. PID controller (Proportional Integrator Differential) is a tool to control a system, this tool can be used to control the governor in order to have quick response, stable and frequency generated does not exceed the specified tolerances of  $\pm 5\%$ . So with the governor PID controller is able to work with the maximum.*

**Keywords:** governor, generator, PID

### INTRODUCTION

Along with advances in technology and the increasing number of people the need for electrical energy will also increase. As a result, the electrical load will increase as well. With the increase in the load will cause frequent load changes that will affect the supply of electricity to be distributed. Due to the influence of this supply will affect the output of the generator.

The tools used to regulate the speed of a generator is governor. Governor has the function of

regulating the output shaft rotation speed of the engine prime movers installed this regulator [1]. So that could be obtained output shaft rotation speed is stable, even though the load is borne by the machines varied and changeable. With the change of the load controller is needed to control the governor in order to work fast and stable.

A governor is expected to respond to changes quickly so that the system is expected to remain stable. It would require a controller that can adjust the governor. The controller will be used in this paper is a PID controller.

PID controller is a simple controller, which can be implemented using analog electronic circuits. With the PID is the job of the governor is expected to work with a fast, stable and frequency generated does not exceed the desired tolerance.

### METHODOLOGY

#### A. Gavernor

##### 1. Setting Frequency and Active Power

Active power is closely related to the frequency of the system. Provision must be adapted to active power load demand, this adjustment is done by adjusting the generator drive coupling, so it will not be a waste of active power.

In general, the generator used is a three-phase synchronous generator as a major generator [4]. Therefore, the frequency generated depends on the characteristics of the synchronous generator. According to Newton's Law is no relationship between the mechanical coupling activator generator with rotation generators:

$$(T_G - T_B) = H \times \frac{9\omega}{9t} \quad (1)$$

where :

$T_G$  = coupling activator generator

$T_B$  = coupling burdensome load generator

$H$  = the moment of inertia of the generator along with the propulsion engine

$\omega$  = angular velocity of rotation of the generator

So the frequency will drop if the active power generated is not sufficient for the load and vice versa frequency will increase if excess power is active in the system. Mathematically, if:

$$(TG-TB)=\Delta T < 0 \text{ then } \frac{\partial \omega}{\partial t} < 0, \text{ so the frequency drops}$$

$$(TG-TB)=\Delta T > 0 \text{ then } \frac{\partial \omega}{\partial t} > 0, \text{ so the frequency rises}$$

## 2. Governor Principle

Steam turbines are equipped with frequency control is a tool to control the valve. Valve serves to control the capacity of the steam/fuel when the frequency changes due to changes in load. This understanding is known as a speed governor.

The steam turbine is equipped with frequency control and a control valve setting equipment. Control valve will open to increase the capacity of steam/fuel when the frequency drops from the nominal or otherwise, will be shut down to reduce the capacity of steam/fuel when the frequency rises. This understanding is commonly known speed governor. Type governor, among others, MHC (Mechanic Hydraulic Control) and EHC (Electric Hydraulic Control) [4].

## B. Steam Power Plant Electrical System Modeling

### 1. Mathematical Modelling of Power System in Steam Power Plant

Figures 1 and 2 is a representation of a system of Steam Power Plant[2].

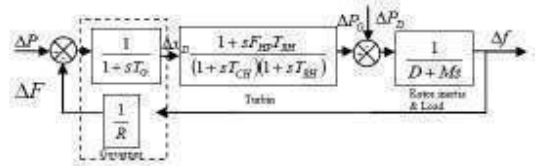


Figure 1. Block diagram of the system with reheat steam turbine power plant [2]

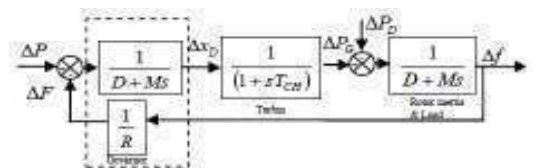


Figure 2. Block diagram of power plant systems with non-reheat steam turbine [2]

### 1. Governor the steam power plant modeling system using Matlab Simulink

In Figure 3 is a simulated image when free governor is locked. So for setting the load when there is a change in the frequency of working load

limit load control use. This means that when there is a decrease or increase in frequency and impact on the decline or increase in cost of limited value. When the value has reached the limit specified, then the governor control that works. System load settings like this is called the limit load operation mode with automatic governor trajectory.

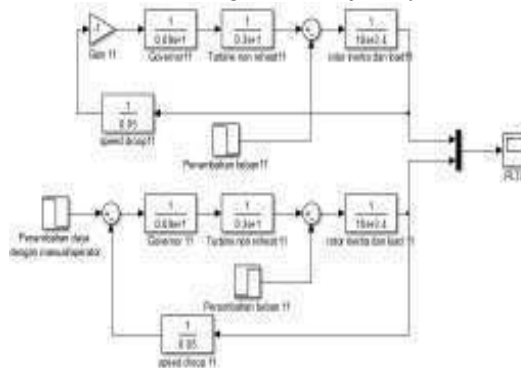


Figure 3. Simulink system without PID Controller

With the addition of the PID controller is expected systems and graphs generated by the simulation results can be fast, stable and frequency generated does not exceed the specified tolerance limits.

## C. PID Controller

The PID controller has a very big influence on the system. In principle it can not be reformed due to compiler component of the system. This means that a plant can not be changed until the change is made by adding a sub- system that is the controller.

One of the functions of the controller is reduced the error signal, ie the difference between the signal settings and actual signal from the system. The purpose of the control system is to get the actual desired signal according to the signal settings. The faster the reaction system to follow the actual signal and the smaller the error occurs, the better the performance of the control system is implemented.

When the difference between the setting of the output value, the controller should be able to observe the true difference is to immediately produce output signals to influence plant. Thus the system is quickly transformed plant output is obtained through the difference between setting the scale of the set as small as possible.

In the PID controller parameters are to be determined. The parameters are Kp, ti, rd. Where Kp is the proportional component of the controller, ti is a component of the controller integrator and rd is a component of the differential controller [3].



$$K_p = \frac{\tau}{\tau * k} \quad (4)$$

$$\tau_i = \tau \quad (5)$$

$$\text{Gain} = \frac{1}{\tau_i} \quad (6)$$

In the system there is some order that is the system order 1, order 2 and order more than 2. In the system there are parameters in each order. To order 1 are the parameters of equation 7. To order 2 or more parameters are parameters of the equation 8.

$$\text{Parameter: } K, \tau \rightarrow \frac{K}{\tau s + 1} \quad (7)$$

$$\text{Parameter: } K, \zeta, \omega_n \rightarrow \frac{K}{\frac{1}{\omega_n^2} s^2 + \frac{2\zeta}{\omega_n} s + 1} \quad (8)$$

Every shortcomings and advantages of each controller P, I and D can cover each other in parallel by combining all three into a proportional plus integral controller plus differential (PID controller). Elements of controller P, I and D respectively as a whole aims to accelerate the reaction of a system, eliminating the offset and generates a large initial change [3].

Here are the steps to design a PID controller:

1. Determine the transfer function of the plant
2. Determine the specifications desired order response performasi
3. Determine  $K_p$ ,  $\tau_i$ ,  $\tau_d$

$$\tau_i = \frac{2\zeta}{\omega_n} \quad (9)$$

$$\tau_d = \frac{1}{2\zeta\omega_n} \quad (10)$$

$$K_p = \frac{2\zeta}{\tau * \omega_n * K} \quad (11)$$

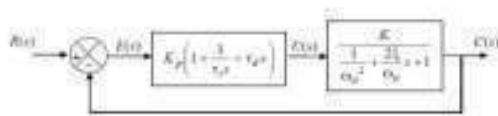


Figure4. Block diagram of PID controller

Figure 4 is a block diagram of PID controller. Tuning parameters of PID controller (Proportional Integral Differential) is always based on the review of the characteristics that set (Plant). Thus however complicated a plant, the plant's behavior must be known before the PID parameter tuning was done. Because the plant mathematical modeling is not easy, then developed an experimental method. This method is based on the reaction of a plant which is

subject to change. Two experimental approach is Ziegler-Nichols and methods Quarter decay.

## DISCUSSION AND ANALYSIS

From the simulation results obtained with the unit step the image of the output signal of the plant is like Figure 6. After getting the plant output image will be to identify the plant so that the plant is not so complicated equation. The results of the identification of the plant can be seen in Figure 5.

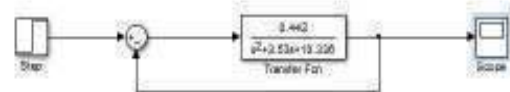


Figure5. The result of the calculations system without PID Controller

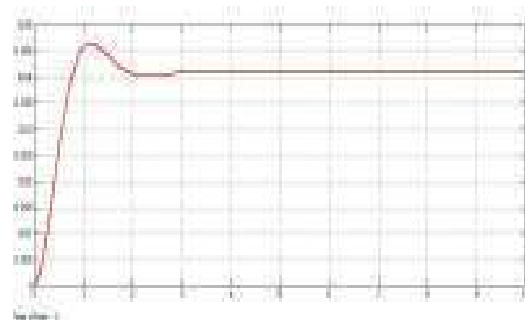


Figure6. Simulation results of the system with unit step

From the results of calculations to determine the PID parameters are  $K_p$ ,  $\tau_i$ ,  $\tau_d$ . Then obtained values of  $K_p$ ,  $\tau_i$ ,  $\tau_d$  is

$$K_p = 4$$

$$\tau_i = 11.7$$

$$\tau_d = 1.13$$

These parameters will be incorporated into the Simulink of PID controller.

Figure 7 is a picture of the Simulink system created and with the addition of PID. PID is placed before the entrance to the governor that the signal frequency generated does not exceed the specified tolerances.

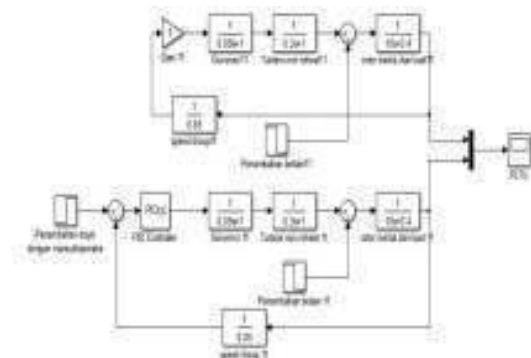


Figure 7. Simulink system with PID Controller

Figure 8 is a picture of the results of running the system with PID simulink. In drawing black lines indicate when the system coupled with the burden of making it look that the frequency will decrease. In the picture the red line indicates when the system is coupled to the load so that it appears that the frequency will decrease tetapi masih within the limits specified frequency tolerance is  $\pm 5\%$ .

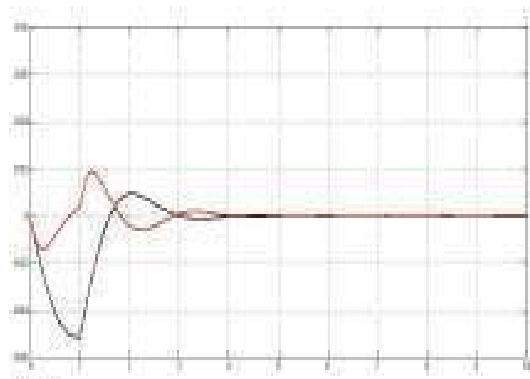


Figure 8. Simulation results of the system with PID Controller

## CONCLUSION

1. From the simulation results obtained PID system of the plant without the resulting frequency that exceeds the specified tolerances of  $\pm 5\%$ .
2. With the PID, then the frequency of less than  $\pm 5\%$  with speed and stability in achieving steady state is nearly equal.

## Bibliography

- [1] Imam Robandi, Modern Power Sistem Control, ANDI Publisher, 2009
- [2] Imam Robandi, Desain Sistem Tenaga Modern, ANDI Publisher, 2006
- [3] Desain Kontroler Proporsional Ditambah Integral Ditambah Differensial (PID), Diktat Sistem Pengaturan, 2005
- [4] Patriandari, Analisis Pengoperasian *Speed Droop Governor* Sebagai Pengaturan Frekuensi Pada Sistem Kelistrikan PLTU Gresik, Tugas Akhir ITS, 2010

## DESIGN AND DEVELOPMENT OF VACUUM DISTILLER FOR BIOETHANOL PRODUCTION

**Muhammad Aziz Muslim and Goegoes Dwi Nusantara**

Electrical Engineering Department, Brawijaya University

Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Email: muh\_aziz@ub.ac.id, goegoesdn@ub.ac.id

### **Abstract**

*Gasoline and diesel are the main fuels used in motor vehicles nowadays. As the consequence, its availability becomes very important. As the two fuels are non-renewable, alternative fuels needed to replace gasoline and diesel function. Biodiesel which is extracted from the seeds of the plant is an alternative to diesel fuel. While bioethanol is a promising fuel substitute for gasoline. Bioethanol purification process carried out by distillation followed by a dehydration process. In this research, design and development of bioethanol distillation under vacuum conditions is proposed. Under vacuum condition, it is expected to produce bioethanol with high concentration without the need for dehydration process. Experimental results using temperature control strategies at constant pressure showed that our apparatus could increase concentration of ethanol up to 88% in only 2 hours. This result can be improved by controlling the temperature and pressure in an integrated manner.*

**Keywords:** bioethanol, vacuum distiller, temperature control at constant vacuum pressure

### **INTRODUCTION**

Along with the progress of human civilization, the need for energy is increasing. According to projections from the International Energy Agency (IEA), the average energy demand will increase by 1.6% per year. Approximately 80% of the world's energy needs are supplied from fossil fuels. On the other hand, according to petroleum experts, fossil fuels are expected to run out in 30 years. To overcome this, it is necessary escalation of the use of renewable energy instead of fossil fuels.

Transportation sector gives significant percentage (28.1%) in the use of fossil fuels, primarily to the type of gasoline and diesel fuel which is the primary fuel for motor vehicles. Recognizing this, efforts have been made to find an alternative for the two fuels. Biodiesel extracted from the seeds of the plant is an alternative to diesel fuel. While ethanol is a promising fuel substitute for gasoline [1][2][3][4][5][6]. Bioethanol is

obtained from the fermentation of vegetable materials that contain sugar. These materials may include sugar cane, cassava, potatoes, wood, grass and so on [3].

Bioethanol production process begins with the extraction of sugar from various plant materials. Furthermore fermented using chemicals such as yeast. This process will produce bioethanol with the percentage of 7% -10% [7]. The process followed by distillation. Results of distillation are generally able to produce alcohol with a percentage of about 70%. With reflux technique, the distillation can be increased up to 95% concentration [8]. To increase the ethanol content of 99.5% (known as Fuel Grade Ethanol) is usually done with the addition of water absorbent. The absorption process takes 2-3 days. Another way is to adjust the pressure to near vacuum conditions [4]. But this is quite difficult because the pressure is affected by temperature [9].

To overcome these difficulties, this study proposed the design and development of a vacuum distiller controlled by an electrical equipment. The basic idea of this research is to maintain the heating process at a certain temperature and while keep the pressure on distillation tank under near-vacuum conditions. By using the proposed mechanism is expected to obtain high concentration ethanol in a relatively shorter time.

### **BIOETHANOL DISTILLATION**

Distillation is a process for separating substances of a solution based on difference in boiling point of the substances. Purification of bioethanol is one that uses the principles of distillation process for separating pure alcohol with water.

Theoretically, distillation result will not be able to produce bioethanol with concentration of above 95% (as in Fig. 1). This is due to the phenomenon of formation of azeotrope of water and ethanol. This mixture has a lower boiling point than pure water vapor point (100°C at a pressure of 1 atmosphere) and the boiling point of pure ethanol (78.5°C at 1 atmosphere pressure). Fig.1 shows azeotrope at 1 atmosphere pressure.

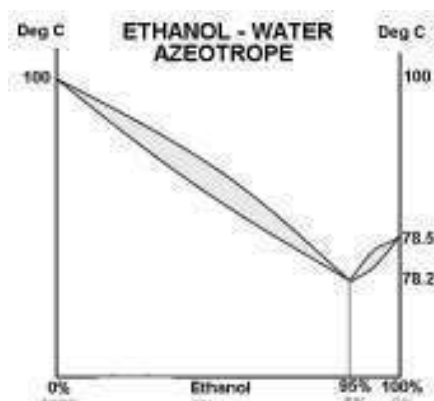


Fig 1. Boiling Point Ethanol-Water Mixture at Atmospheric Pressure. (Adopted from [10])

To produce nearly pure bioethanol, usually dehydration process is done by using water absorbent substances, such as zeolites and salt. This process will take 2 to 3 days. The process of distillation at a pressure below 1 atmosphere has different results. Fig. 2 illustrates this phenomenon. At less than 1 Atmospheric pressure, the boiling point of pure water and alcohol will drop from the normal condition. Fig. 3 shows that at a pressure of 0.1 Atm, pure ethanol (100%) will be obtained at a temperature of about 30°C [12]. Vacuum distillation process has another drawback, namely the boiling point of pure water, pure alcohol and a mixture of both are very close each other. So, we need a precision temperature-pressure control system. On the other hand, temperature and pressure are two variables that influence each other [9]. So, we need a mechanism for integrated control of temperature and pressure to yield nearly pure bioethanol.

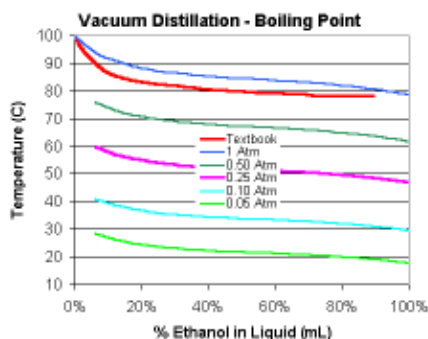


Fig. 2. Ethanol Distillation under Atmospheric Pressure (Adopted from [12])

Focus of this research is to carry out distillation of low concentration bioethanol to gain nearly pure bioethanol through vacuum distillation.

It is that bioethanol purification time will become shorten from 2-3 days to only several hours.

## DESIGN AND DEVELOPMENT OF VACUUM DISTILLER FOR BIOETHANOL

Vacuum distiller was built based on [13] and [14]. Designed vacuum distiller consists of 5 main parts:

1. Distillation tube. This tube is equipped with jacket and stirrer. Direct heating is done in a jacket filled with coconut oil using 2000 watts electric heater. Heat then conductively spread to the bioethanol. With a tank capacity of 25L, it is expected to reach a temperature of about 50°C within 30 minutes. The tank is equipped with stirrer, to equally distribute the heat, and PT100 temperature sensor. Fig. 3 shows distillation tube while Fig. 4 shows location of the sensor inside the tube. Low concentration bioethanol can be fed into the distillation tube by opening the top lid of the tube after initiating heater.



Fig. 3. Distillation Tube

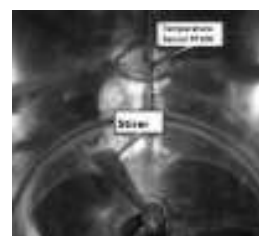


Fig. 4. Location of Temperature Sensor PT100

2. Condensation Tube, is a place where bioethanol vapor condensed. Inside the tube is an eight meters length spiral metal hose to make condensation process faster.
3. Accumulator, is a place for distillation result. It is placed directly under condensation tube to make distilled bioethanol turn down due to gravitation.
4. Vacuum apparatus. We used one of double jet water pump hose to create vacuum mechanism. An 0.1 Atm pressure can be made by using this mechanism. This pump is also used to circulate cooling water for condensation tube.

5. Control Panel. It is a place for controller and switches. Fig. 5 displayed inner view of the control panel box. The switches are used to activate two motors (for water jet pump and stirrer) and as a main switch. An on-off controller (Omron E5CSL) is used to control 8 heaters based information from PT100 temperature sensor. Fig. 6 explain detail location of each parts.



Fig. 5. Inner View of the Control Panel Box

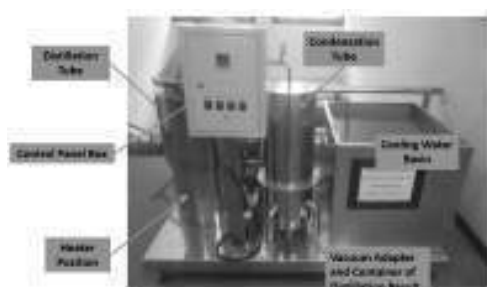


Fig 6. The Vacuum Distiller

## EXPERIMENTAL RESULTS AND DISCUSSION

Experiments were conducted using two kind of raw materials, namely 70% ethanol and bioethanol resulted from the fermentation. The first material is to check whether our apparatus could increase concentration of ethanol or not. While the second is to check capability of using the real raw material

The procedure of the first type experiment and the results are explained as follows. The sample was distilled with setpoint of 66°C. To achieve the temperature setpoint, the setting of temperature controller is gradually increased from 50°C, 57°C, 61°C and finally 66°C to prevent temperature exceeding the setpoint. Vacuum pressure is set to be 0.5 Atm and then deactivated. Distillation was done for 120 minutes. At the initial temperature of 24°C

up to 60°C, vacuum pressure could be maintained at 0.5 Atm. At a temperature of 61°C the pressure began to increase. To anticipate this pump was activated. The temperature could be maintained at 66°C until 120 minutes under 0.3 of Atmospheric pressure. After two hours we have distillation result of 88% ethanol.

The second type experiment was conducted by using fermentation result of 78% sugar content of molasses. Our equipment was failed to measure initial concentration of this bioethanol. Using similar procedure as in the first type of raw material experiments were conducted. However the results were remain unsatisfactory. Best result so far just found bioethanol contents of 20%. We argue that the most influenced factor of this fault was due to unsuccessful fermentation. Another factor to be considered was that vacuum pressure was not monitored and controlled in real-time. Only one variable, temperature, were considered as controlled variable. In fact temperature and pressure has a very close relation. In a simple word, temperature and vacuum pressure should be controlled in integrated manner. This issue will be the topic of our further study in near future.

## CONCLUSIONS

From the design, development, and experimental results, it can be concluded that:

- The vacuum distiller apparatus is working properly for the raw material from lower concentration ethanol, meanwhile it needs improvement to be working properly for raw material from the fermentation result.
- It is necessary to include information from vacuum pressure sensor as control variable and to use advanced control strategy to control temperature and vacuum pressure in integrated manner.

## References

- Ali, M., N., Mohd, M., K., Mohiudin, M., 2011, "Etahanol Fuel Production Through Microbial Extracellular Enzymatic Hydrolysis and Fermentation from Renewable Agrobased Cellulosic Waste," *International Journal of Pharma and Bio Science*, 2(2):B321-B331.
- Dias, M., O., S., Ensinas, A., V., Nebra, S., A., Filho, R., M., Rossel, C., E., V., Maciel, M., R., W., 2009, "Production of Bioethanol and Other Bio-based Materials from Sugarcane Bagasse: Integration to Conventional Bioethanol.

## MODELING AND SIMULATION OF STEERBY WIRE CONTROL SYSTEM USING FUZZY LOGIC

Fachrudin<sup>1</sup>, Imam Robandi<sup>2</sup>, Nyoman Sutantra<sup>3</sup>

<sup>1</sup> Electrical Engineering Dept., Widyagama Univ., Malang, fadin.ft@gmail.com

<sup>2</sup> Electrical Engineering Dept., ITS Surabaya, robandi@ee.its.ac.id

<sup>3</sup> Mechanical Engineering Dept., ITS Surabaya, tantra@me.its.ac.id

### Abstract

*One part of the development of electric car technology is the electric steering system (steer-by-wire) that is expected to improve the dynamic performance of the vehicle. Simulation of vehicle steering control system of the plant carried on the vehicle model (full vehicle model) with 10 degree of freedom (DOF). Lateral motion and yaw motion of the vehicle model are designed as plant output, and steering angle as plant input. Fuzzy logic control is applied to suppress errors in lateral motion and subsequent to further refine the plant output to match the desired trajectory (double lane change test) performed yaw motion control using PID control. Simulation results show that the fuzzy logic control system and PID able to adjust well to the plant output trajectory required by the C-RMS error 0.00448.*

**Keywords:** vehicle models, lateral motion, yaw motion, a fuzzy logic control

### INTRODUCTION

Steer by Wire system is part of the development of electric car technology is expected to be the future vehicles with high performance control [1]. Steering control is a necessary activity to determine the longitudinal direction of movement of the vehicle in order to always be right in the direction of the specified path. In the development of active safety systems improvement and to anticipate nonlinear behavior, it is necessary to control the longitudinal movement against lateral and yaw movement yet still taking into account its impact on all the movements of the vehicle dynamics. This means that when the vehicle is in motion or maneuver it will affect all the movement of the vehicle dynamics [2].

Artificial intelligence has provided a discourses and an inspiration because it has the advantage to perform multiple tasks more quickly, consistently and accurately [3]. Use of Artificial Intelligence in the computing process greatly helps in speeding up the optimization process and control systems. Fuzzy Logic Control (FLC) is a behavior-

based control system (behavior-based controller) is becoming a major alternative to the use of the steering control system [3] because the FLC is a control system that is reliable enough to overcome nonlinearities system, but must be supported by an optimization method for tuning optimal fuzzy parameters quickly and accurately [4].

In this paper was developed a model and simulation of vehicle steering control system using FLC is applied to the vehicle models that represent the 10 degree of freedom of vehicle dynamics to improve the performance of the vehicle dynamics. The strategy of the control system is consists of two stages in cascade, is the lateral motion control to eliminate unwanted lateral movement and subsequent control is yaw motion control as a complement to the steering input. The structure of control system is built using FLC as a main control on the lateral motion control and Proportional-Integral-Derivative controller (PID) as a further control on the yaw motion control.

### VEHICLE DYNAMICS MODEL

Based on the concept of vehicle dynamics, vehicle model has two main functions in controlling the movement of vehicles, that is control lateral and longitudinal control [5]. In this paper simulates steering controls using vehicle models with 10 degree of freedom (DOF) that consists of a 7-DOF model of vehicle ride and 3-DOF vehicle handling model [6], [7].

#### Vehicle Ride Model

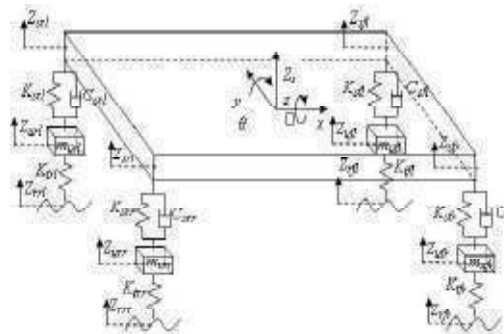


Figure 1. Vehicle ridemodel

Vehicle Ride Model is represented as a 7-DOF system that expressed in the 7 Newtonian mathematical equation, consisting of mathematical equations on the vehicle body (sprung mass single) that includes freedom of movement; vertical movement of the vehicle body (heaving), nodding movement of the vehicle body (pitching), swaying movement from side to side of the vehicle body (rolling) and vertical movement of each wheel (four unsprung masses) [6], [7]. Suspensions between the sprung mass and unsprung masses are modeled as a passive viscosity dampers and spring element. While the tire is modeled as a simple linear spring without damping. The balance of forces on the sprung mass (heaving) expressed on Figure 1.

### Vehicle Handling Model

Vehicle handling models represented as 3-DOF system which means it has 3 Newtonian mathematical equations consisting of mathematical equations for the movement of the car body in the lateral, longitudinal and yaw [5], [8] which refer to figure 2. Lateral motion and longitudinal motion is the movement of vehicles along the x-axis and y-axis is expressed in lateral acceleration ( $a_y$ ) and longitudinal acceleration ( $a_x$ ) so that the lateral motion and longitudinal motion can be obtained by double integration of the lateral and longitudinal acceleration.

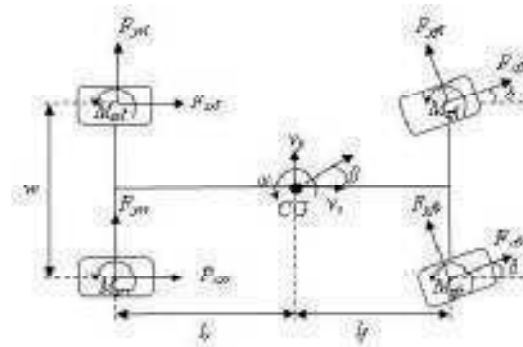


Figure 2. Vehicle handling model

### VEHICLE STEERING SYSTEM MODEL

The designing of the vehicle model with 10 DOF focus on vehicle front wheel alignment as the plant output, and the input of the plant in the form of the steer angle variation. Plant output is expressed in yaw, lateral and longitudinal motion. Vehicles model include: ride models, tire models, and the handling model built using MATLAB - SIMULINK. applications software.

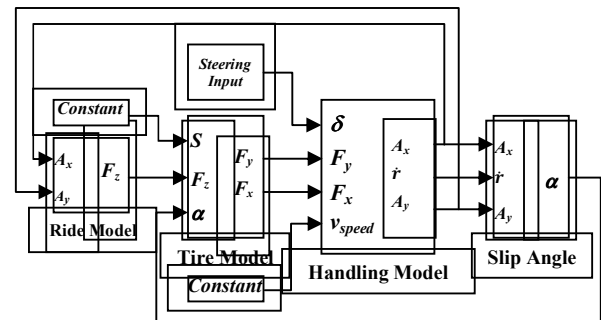


Figure 3. Vehicle Model on MATLAB – SIMULINK

### CONTROL STRATEGY

The designing control strategies by using the cascade control system that is the FLC and PID [27].

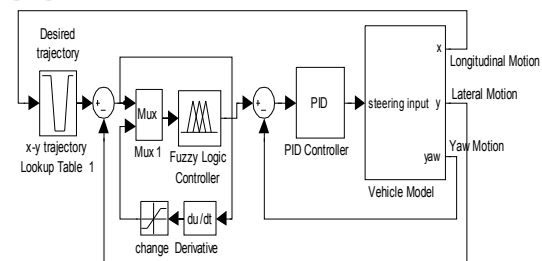


Figure 4. Control System Strategy Model

FLC is a major control on the structure of the control system to minimize the error between the input and output of the plant which is the lateral motion. The use of Fuzzy Logic Control to resolve problems on a system that has a complex behavior, thus choosing the FLC can be overcome nonlinearities of the controlled plant. FLC is built with 2 inputs (error (ER) and delta errors (DE) between the lateral motion against the reference) and one output (OT).

Membership Function (MF) is a function to express the degree of membership fuzzy. MF shape used in this paper is 3MF; 2 trapezium shaped and one triangle, so that the total required rule base is 9 rule, each MF has the term language; Negative Medium (NM), Zero (Z), Positive Medium (PM), subsequently drafted base rules set by the control law IF (ER) AND (ED), THEN (OT). Defuzzification strategy used is the strategy center of area (COA). This strategy is done to produce a non-fuzzy control action (crisp).

The second control is a PID control, which serves to enhance FLC control system. FLC output is used as the setting point on the yaw motion, ideally it gives the sense that the vehicle has been moved without any lateral force, in other words that

the yaw motion is equal to zero. PID control is used as a second control to eliminate the error between the set point against the yaw motion.

Performance of Control P, I, and D is highly dependent on the determination of the value of the constants  $K_p$ ,  $K_i$  and  $K_d$ . In this section the value of the constants  $K_p$ ,  $K_i$  and  $K_d$  can be determined by trial and error as well as the optimization to achieve the value of errors on the lateral motion is considered small.

## SIMULATION AND RESULTS

Simulation of vehicle steering control system uses a variation of steer angle input, in the form of a lookup table x - y trajectory (double lane change) and the plant output is expressed in yaw, lateral and longitudinal motion, constant speed = 13.8 m/s, FLC and PID parameters like in Table 1 and 2, the simulation performance expressed in C-RMS error = 0.004480. The simulation results as shown in Figure 5 and 6:

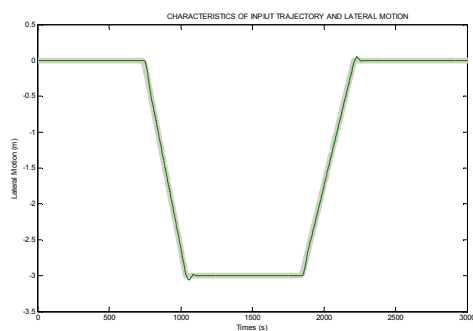


Figure 5. Characteristics of the input trajectory and lateral motion.

Table 1. FLC Parameter

ERROR INPUT			
	Width Left	Midpoint	Width Right
NS	-0.7466	-0.7466	0
Z	-0.7466	0	0.7466
PS	0	0.7466	0.7466
DELTA ERROR INPUT			
	Width Left	Midpoint	Width Right
NS	-33.7435	-33.7435	0
Z	-33.7435	0	33.7435
PS	0	33.7435	33.7435
OUTPUT			
	Width Left	Midpoint	Width Right
NS	-0.38085	-0.38085	0
Z	-0.38085	0	0.38085
PS	0	0.38085	0.38085

Table 2. PID Parameter

PID PARAMETER		
$K_p$	$K_i$	$K_d$
521	10	6

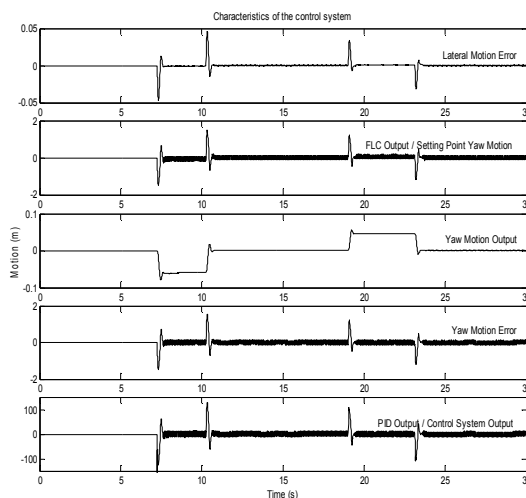


Figure 6. The characteristics of the control system

## CONCLUSION

The simulation results showed that the simulation of vehicle steering control system using FLC and PID, lateral motion can be maintained in accordance with the trajectory of the double lane change steering input with the C-RMS error 0.004480. The results of this simulation are the first step of the development of an optimal control system for further testing can be done through HILS (Hardware in the Loop simulation).

## Reference

- [1] S.-H. Jang, T.-J. Park, and C.-S. Han, "A control of vehicle using steer-by-wire system with hardware-in-the-loop-simulation system," presented at the 2003 IEEE/ASME International Conference on Advanced Intelligent Mechatronics, 2003. AIM 2003. Proceedings, 2003, vol. 1, pp. 389 – 394 vol.1.
- [2] J. Villagra, B. d' Andrea-Novell, H. Mounier, and M. Pengov, "Flatness-Based Vehicle Steering Control Strategy With SDRE Feedback Gains Tuned Via a Sensitivity Approach," *Ieee Trans. Control Syst. Technol.*, vol. 15, no. 3, pp. 554 –565, May 2007.
- [3] A. Adriansyah and S. H. M. Amin, "Learning of fuzzy-behaviours using Particle Swarm Optimisation in behaviour-based mobile robot," *Int J Intell Syst Technol Appl*, vol. 5, no. 1/2, pp. 49–67, May 2008.



- [4] S. Wei, M. Liu, and Y. Song, "The Optimizing of Fuzzy Control Rule Based on Particle Swarm Optimization Algorithms," Washington, DC, USA, 2009, pp. 645–648.
- [5] P. Falcone, F. Borrelli, J. Asgari, H. E. Tseng, and D. Hrovat, "Predictive Active Steering Control for Autonomous Vehicle Systems," *Ieee Trans. Control Syst. Technol.*, vol. 15, no. 3, pp. 566–580, May 2007.
- [6] K. Hudha, Z. A. Kadir, M. R. Said, and H. Jamaluddin, "Modelling, validation and roll moment rejection control of pneumatically actuated active roll control for improving vehicle lateral dynamics performance," *Int. J. Eng. Syst. Model. Simul.*, vol. 1, no. 2/3, p. 122, 2009.
- [7] F. bin Ahmad, K. Hudha, and H. Jamaluddin, "Gain Scheduling PID Control with Pitch Moment Rejection for Reducing Vehicle Dive and Squat," *Int. J. Veh. Saf.*, vol. 4, no. 1, 2009.
- [8] M. R. Stone and M. A. Demetriou, "Modeling and simulation of vehicle ride and handling performance," presented at the Proceedings of the 2000 IEEE International Symposium on Intelligent Control, 2000, Rio Patras, 2000, pp. 85–90.

## EIGENVALUE STABILITY ANALYSIS BASED ON VALUE GENERATOR EXCITATION SYSTEM MODEL ON SMIB

Hilmansyah<sup>(1)</sup>, Mei Aditya<sup>(2)</sup>, Rahmat<sup>(3)</sup> dan Imam Robandi<sup>(4)</sup>  
(1,2,3,4)Jurusan Teknik Elektro, Institut Teknologi Sepuluh Nopember (ITS)

### Abstract

*Excitation System on a Single Machine Infinite Bus (SMIB) influence on the power system. This paper will discuss the value Eigenvalue Based Stability Analysis Model Excitation System on Single Machine Infinite Bus (SMIB). From the experimental results showed that the excitation system model on a Single Machine Infinite Bus (SMIB) with parameters that made the result Stable.*

**Keywords:** Excitation System, Single Machine Infinite Bus, Value Eigenvalue

### INTRODUCTION

To solve the problem of dynamic control systems, information systems must be obtained. Before performing stability analysis, necessary to analyze the control and observation. These analyzes is a requirement to design a system setting. SMIB is a system that channels the power of the machine to infinite bus (infinite bus). Eigenvalue is to determine the value of the system is stable or not. State Space is the mathematical modeling of a plant or system used to control a system problem resolution.

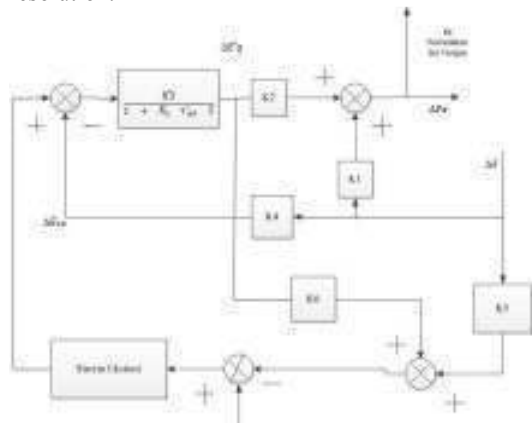


Figure1. The block diagram generator excitation control system on SMIB

### METHOD

Simple system

$$\dot{x} = Ax + Bu$$

$$y = Cx + Du$$

$x$  = Matriks variable keadaan sistem ( $n \times 1$ )

$u$  = Matriks variable input sistem ( $r \times 1$ )

$y$  = Matriks variable output ( $m \times 1$ )

$A$  = Matriks sistem ( $n \times n$ )

$B$  = Matriks ( $n \times r$ )

$C$  = Matriks Pengukuran ( $m \times n$ )

### Stability

Characteristics eigen values

$$a_0\lambda^n + a_1\lambda^{n-1} + a_2\lambda^{n-2} + \dots + a_{n-1}\lambda + a_n = 0$$

The system is stable if the roots of the characteristic equation is the imaginary axis on the left.

Matrix computations using MATLAB software

$A =$

0	1.1700	0	0	0
-0.0909	-1.1364	-0.1864	0.4545	0
-1.5400	0	-1.9048	0	2.0000
0	-0.0872	0	-1.0204	0
-6.0116	0	-7.5145	0	-0.5780

$B =$

0	0
0	0
0	0
1.0204	0
0	3.0058

$C =$  1 0 0 0 0

Eigenvalue =

-1.2448 + 3.8424i  
-1.2448 - 3.8424i  
0.0552  
-1.1026 + 0.1744i  
-1.1026 - 0.1744i  
 $\lambda_1 = -1$  dan  $\lambda_2 = -6$

The plot using MATLAB:



Eigenvalues of the value above which there is a value to the right of the imaginary axis located so that the system is unstable.

## CONCLUSION

After analyzing COS (controlability, observability and Stability) SMIB with Governor with these parameters it can be concluded that the system can be in control, still can be observed and stable.

## Referensi

- Imam Robandi, Modern Power System Control: Desain, Analisis & Solusi Kontrol Tenaga Listrik, ANDI Publisher, 2006.
- Katsuhiko Ogata, Discrete Time Control Systems 2<sup>nd</sup> Edition.
- Katsuhiko Ogata, *State Space Analysis of Control System*, Prentice Hall, Upper Saddle River, New Jersey, 2002.

## ANALYSIS OF BIDIRECTIONAL BUCK-BOOST CASCADE CONVERTER PERFORMANCE WITH STATIC LOAD USING PSIM

Muhammad Taufiq Ramadhan<sup>1)</sup>, Dedet Chandra Riawan<sup>2)</sup>, Imam Robandi<sup>3)</sup>

Department of Electrical Engineering, Faculty of Industrial Technology,  
ITS, Kampus ITS Sukolilo, Surabaya-60111, Indonesia

<sup>1)</sup>atreides\_03@yahoo.com; <sup>2)</sup>dedet.riawan@ee.its.ac.id; <sup>3)</sup>robandi@ee.its.ac.id

### Abstract

The use of Bidirectional Buck Boost Cascade Converter is still new and unfamous, which presents a suitable control in case to save more energy. This paper presents an analysis for Bidirectional Buck Boost Cascade Converter performances with static load designed by using PSIM software. The proposed concept is a development of a Bidirectional Buck Boost Converter to improve the performances. Using the modification into a close loop system, Buck Boost Cascade Converter can minimize the drop voltage and give a better result by installing the PID controller in feedback system as an error correction.

**Keywords:** Bidirectional Buck Boost Cascade Converter, PID Controller

### INTRODUCTION

Bidirectional Buck Boost Cascade Converter is still new and unfamous, which very recommended to use in case to save more energy.

The layout of the topology being considered in this research is accomplished by means of the cascade of a stepdown converter with a step-up one, as shown in Fig. 2.1. The converter topologies require one inductor and two electrolytic capacitors.<sup>[3]</sup>

In close loop design, it requires additional modified PWM to adjust the IGBT switch and PID controller to minimize the output error.<sup>[2]</sup>

### BIDIRECTIONAL BUCK BOOST CASCADE CONVERTER

Design of Bidirectional Buck Boost Cascade Converter using the gate-1 for feedforward operation, and the gate-2 for backforward operation. Stepping down or stepping up the battery voltage operated by changing the duty cycle.

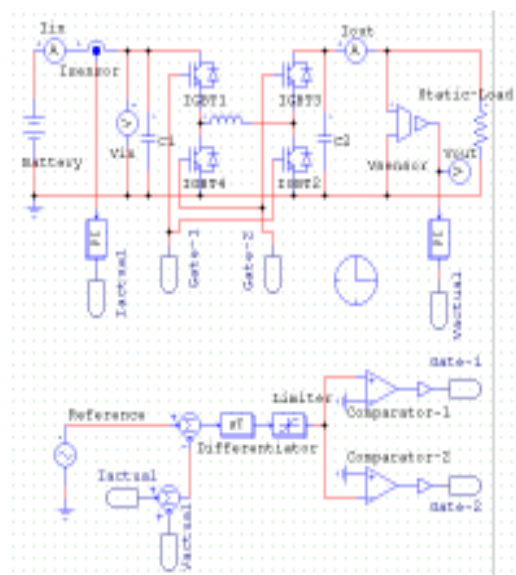


Fig. 2.1. Bidirectional Buck-Boost Cascade Converter close loop system.

Basically, we use the same formula with the basic Buck Boost Converter for stepping up either stepping down the battery voltage.

The basic formula of Buck Boost Converter :

$$V_{out} = -V_{in} \cdot \frac{k}{(1-k)} \quad (1)$$

$V_{out}$  = Output voltage to load

$V_{in}$  = Input voltage from battery

$k$  = Duty Cycle =  $t_{on} / (t_{on} + t_{off})$

From the formula (1), we can divide in some condition :

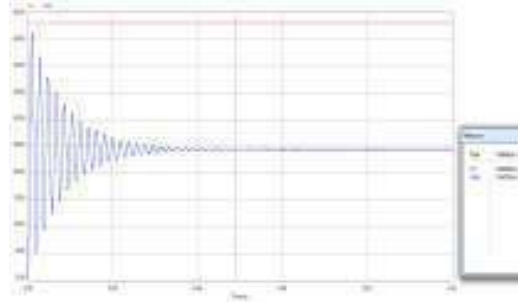
- If  $k < 0,5$  then work as buck mode to stepping down the battery voltage (backforward).
- If  $k = 0,5$  then  $V_{in} = V_{out}$
- If  $k > 0,5$  then work as boost mode to stepping up the battery voltage (feedforward).<sup>[1]</sup>

## RESULTS AND DISCUSSIONS

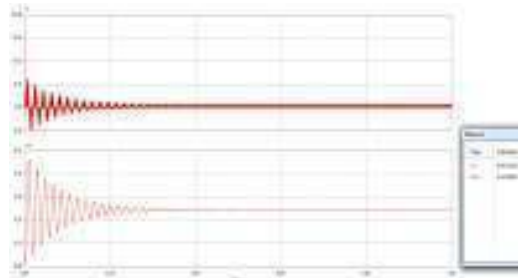
The result of simulation can be seen at these graphic pictures.

### Buck mode ( $k = 1/3$ )

$V_{in} > V_{out}$

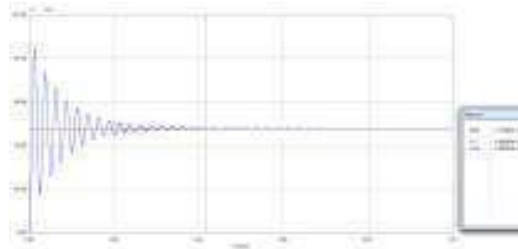


$I_{in}$  and  $I_{out}$

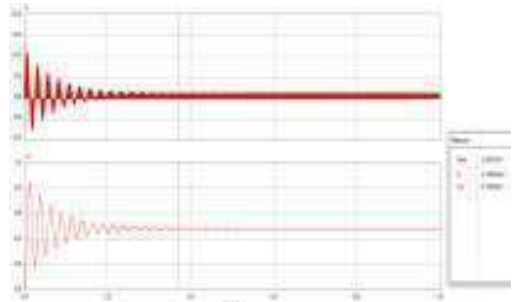


### ( $k = 1/2$ )

$V_{in} = V_{out}$



$I_{in}$  and  $I_{out}$

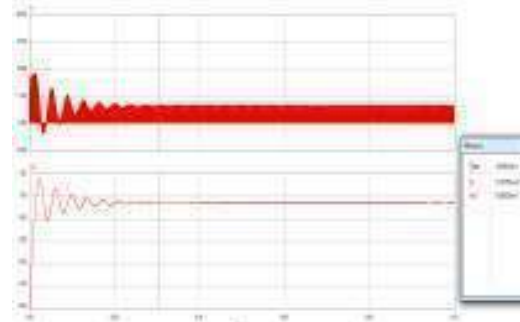


### Boost mode ( $k = 2/3$ )

$V_{in} < V_{out}$



$I_{in}$  and  $I_{out}$



## CONCLUSION

This system shown a very good result and minimum error in every duty cycle changes.

## References

- [1] MochamadAshari, "Sistem Konverter DC-Desain Rangkaian Elektronika Daya", ITS Press,2012.Surabaya.
- [2] Katsuhiko Ogata, "Teknik Kontrol Automatik (Sistem Pengaturan) Jilid 1-2", Erlangga,1985. Jakarta.
- [3] Caricchi, F. Crescimbeni, F.Giulii Capponi, L. Solero, "Study of Bi-Directional Buck-Boost Converter Topologiesfor Application in Electrical Vehicle Motor Drives".IEEE,1998.

## COS IDENTIFICATION AND DESIGN OF WATER TURBINE CONTROL WITH LQR METHOD

Ratih Mar'atus S.<sup>(1)</sup>, Aji Akbar F.<sup>(2)</sup>, Ribka Stephani<sup>(3)</sup>, Hidayatul Nurohmah<sup>(4)</sup>, Imam Robandi<sup>(5)</sup>

<sup>(1,2,5)</sup> Institute of Technology Sepuluh Nopember Surabaya (ITS)

<sup>(3)</sup> Kristen Petra University, Surabaya

<sup>(4)</sup> Darul 'Ulum University, Jombang

ITS Sukolilo Campus, Surabaya 60111

E-mail: [ratih13@mhs.ee.its.ac.id](mailto:ratih13@mhs.ee.its.ac.id)

### Abstract

*This paper describes the problem about speed control of water turbine using LQR (Linear Quadratic Regulator). Water turbine is input to a generator while turbine rotates due to the mechanical power boost of water coming out of the dam water pipeline. There is a complementary tool that can set the turbine rotation is governor. Linear model of water turbine and governor can be analyzed first before giving control to the simpler system. The analysis used to determine the system can be controlled or not is checking COS (Controllable, observable and Stable). From the results of the identification of the LQR control is given to provide a better response. COS identification results show the system can be controlled. While the LQR control is given to the system can makes damping response larger, faster response and lead to a more stable system.*

**Keywords:** COS, eigenvalue, LQR

### BACKGROUND

Water turbines to convert the energy of water in this case the potential energy, pressure and kinetic into mechanical energy that would drive a generator that will arise voltage. Frequency stability becomes important in power system as it affects the reliability and security of the system. Therefore, the frequency generated by the rotation generator should be considered to be kept stable. Electric power system operating at a steady state will be a balance between electrical power is entered to mechanical power released. Imbalance of both results in frequency or voltage which produced will not be normal and disturbed synchronization system.

To maintain the stability of the power system we need a control system that can adjust the turbine speed. Thus in the paper will present controlling a water turbine and governor system to respond more quickly and stable, so that they can adjust the load changes that occur when connected to a generator. Before the addition of control LQR (Linear

Quadratic Regulator) system that to be controlled then checking or identification COS (Controllable, observable and Stable). Identification is used to know what the system can be controlled and to assess changes in the controlled system response by seeing the changes eigenvalue of value state space system.

### METHOD

This research uses the methods of analysis and simulation that focuses on the improvement of the response to the water turbine governor systems. Simulations carried out with the help of software Matlab m-files and Simulink. In general, steps to design of controller for increase the stability of the water turbine systems are as follows.

#### A. Modeling water turbine

The linear model of water turbine and generator can be formed simply from linear mathematical block diagram shown in Figure 1.

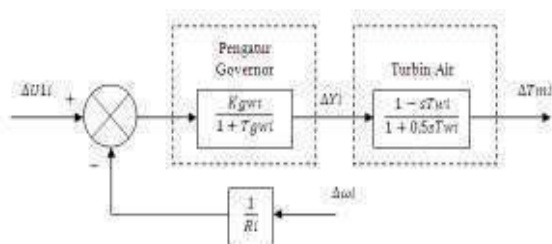


Figure 1. Linear Model Air Turbine And Its setup

In figure 1, the variable  $\Delta Y_1$ ,  $T_{wt}$ ,  $T_{gi}$ ,  $K_{gi}$ ,  $R_i$  and  $\Delta U_1$  in order represents a change in altitude valves, water turbine response time, response time setting water turbines, strengthening regulatory water turbines and changes in the control signal to the engine- $i^{[2]}$ . Therefore, it can be describe into the following equation.

$$\Delta Tm_i = \left[ \frac{2}{T_{w_i}} + \frac{2}{T_{g_{w_i}}} \right] \Delta Y_i - \frac{2K_{g_{w_i}} \Delta U_{1i}}{T_{g_{w_i}}} + \frac{2K_{g_{w_i}} \Delta \omega_i}{R_i T_{g_{w_i}}} - \frac{2\Delta Tm_i}{T_{w_i}}$$

$$\begin{aligned} \Delta \dot{Y}_i &= \frac{K_{g_{w_i}}}{T_{g_{w_i}}} \Delta U_{1i} - \frac{K_{g_{w_i}} \Delta \omega_i}{T_{g_{w_i} R_i}} - \frac{\Delta Y_i}{T_{g_{w_i}}} \\ \Delta \dot{T}_{m_i} &= \left[ \frac{2}{T_{w_i}} + \frac{2}{T_{g_{w_i}}} \right] \Delta Y_i - \frac{2K_{g_{w_i}} \Delta U_{1i}}{T_{g_{w_i}}} + \frac{2K_{g_{w_i}} \Delta \omega_i}{R_i T_{g_{w_i}}} - \frac{2\Delta Tm_i}{T_{w_i}} \end{aligned}$$

State space:  
 $\dot{x} = Ax + Bu$

$$\begin{pmatrix} \Delta \dot{Y}_i \\ \Delta \dot{\omega}_i \\ \Delta \dot{T}_{m_i} \end{pmatrix} = \begin{pmatrix} -1/T_{g_{w_i}} & -K_{g_{w_i}}/(T_{g_{w_i}} R_i) & 0 \\ 0 & 0 & 1 \\ 2/T_{w_i} + 2/T_{g_{w_i}} & (2*K_{g_{w_i}})/(R_i T_{g_{w_i}}) & -2/T_{w_i} \end{pmatrix} \begin{pmatrix} \Delta Y_i \\ \Delta \omega_i \\ \Delta Tm_i \end{pmatrix}$$

$$+ \begin{pmatrix} K_{g_{w_i}}/T_{g_{w_i}} \\ 0 \\ -(2*K_{g_{w_i}})/T_{g_{w_i}} \end{pmatrix} \begin{pmatrix} \Delta U_i \end{pmatrix} \quad [3]$$

$$y = Cx$$

$$y = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{pmatrix} \begin{pmatrix} \Delta Y_i \\ \Delta \omega_i \\ \Delta Tm_i \end{pmatrix}$$

B. Identification COS (Controllable, observable and Stable)

Identify controllable is conducted to determine whether the system can be controlled or not. If a system comply condition of controllable means the system can be controlled. Checking can be done using Matlab with the function  $rank(P)$  where P is a matrix consisting of  $P = [B : AB : A^2B]$ . If the value rank is equal to the matrix A, then the system is controllable.

$$\begin{aligned} A &= \begin{bmatrix} -6,6667 & -0,312 & 0 \\ 0 & 0 & 1 \\ 13,4667 & 0,624 & -0,1333 \end{bmatrix} \\ B &= \begin{bmatrix} 7,8 \\ 0 \\ -15,6 \end{bmatrix} \quad AB = \begin{bmatrix} -52 \\ -15,6 \\ 107,12 \end{bmatrix} \quad A^2B \\ &= \begin{bmatrix} 351,5339 \\ 107,12 \\ -724,2837 \end{bmatrix} \end{aligned}$$

n=3, then:

$$P = [B : AB : A^2B]$$

$$P = \begin{bmatrix} 7,8 & -52 & 351,5339 \\ 0 & -15,6 & 107,12 \\ -15,6 & 107,12 & -724,2837 \end{bmatrix}$$

Identify observable is conducted to see whether the system variables can be measured or not. The simplest way is to use Matlab to identify the function  $det(P)$  and  $rank(P)$ . P is a matrix

$P = [C^T : A^T C^T : A^{T^2} C^T]$ . If the results of the determinants of the matrix P is not equal to zero so that the rank of P is equal to n then the variables system is controllable.

$$A^T = \begin{bmatrix} -6,6667 & 0 & 13,4667 \\ -0,312 & 0 & 0,624 \\ 0 & 1 & -0,1333 \end{bmatrix} \quad C^T = \begin{bmatrix} 1 & 0 \\ 0 & 0 \\ 0 & 1 \end{bmatrix}$$

$$A^T C^T = \begin{bmatrix} -6,6667 & 13,4667 \\ -0,312 & 0,624 \\ 0 & -0,1333 \end{bmatrix}$$

$$A^{T^2} C^T = \begin{bmatrix} 44,4449 & -91,5736 \\ 2,08 & -4,2848 \\ -0,312 & 0,6418 \end{bmatrix}$$

$$P = [C^T : A^T C^T : A^{T^2} C^T]$$

$$P = \begin{bmatrix} 1 & 0 & -6,6667 & 13,4667 & 44,4449 & -91,5736 \\ 0 & 0 & -0,312 & 0,624 & 2,08 & -4,2848 \\ 0 & 1 & 0 & -0,1333 & -0,312 & 0,6418 \end{bmatrix}$$

Identification of stability can be seen from the roots of the system characteristic equation or eigenvalue of matrix A. A system is said to be stable if the roots of the characteristic equation are to the left of the imaginary axis. To obtain the eigenvalues of the matrix A can use the Matlab function is  $eig(A)$ .

C. LQR Control (Linier Quadratic Regulation)

Optimal control system is needed to minimize the performance index for example stability of the system. Design of regulator optimal control system based on quadratic performance index refers to the determination of the matrix elements of K. Values matrix K is obtained from the Q and R, which is a real symmetric matrix and u is not limited. Matrices Q and R are weighting matrices, where the matrix Q determines the precision of the controller, and the matrix R represents the economic cost of the controller. So is the control signal  $u(t) = -Kx(t)$ .

$$\begin{aligned} A &= \begin{bmatrix} -1/T_{g_{w_i}} & -K_{g_{w_i}}/(T_{g_{w_i}} R_i) \\ 0 & 0 \\ 2/T_{w_i} + 2/T_{g_{w_i}} & (2*K_{g_{w_i}})/(R_i T_{g_{w_i}}) - 2/T_{w_i} \end{bmatrix}; \\ B &= \begin{bmatrix} K_{g_{w_i}}/T_{g_{w_i}} \\ 0 \\ -(2*K_{g_{w_i}})/T_{g_{w_i}} \end{bmatrix}; \\ C &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & 0 & 1 \end{bmatrix}; \\ D &= \begin{bmatrix} 0 \end{bmatrix}; \end{aligned}$$

```
0];
N=[];
sys_ss = ss(A,B,C,D);
Q = [1 1 1; 1 1 1; 1 1 1];
R = 1;
[K] = lqr(A,B,Q,R)
Ac = [(A-B*[K])];
Bc = [B];
Cc = [C];
Dc = [D];
sys_cl = ss(Ac,Bc,Cc,Dc)
step(sys_cl)
```

## RESULT AND ANALYSIS

Results COS identification of state space systems using MATLAB water turbine is p =

```
7.8000 -52.0000 351.5339
0 -15.6000 107.1200
-15.6000 107.1200 -724.2837
```

```
>> rank(p)
```

```
ans =
3
```

```
pp =
```

```
1.0000 0 -6.6667 13.4667 44.4449 -
91.5736
0 0 -0.3120 0.6240 2.0800 -4.2848
0 1 0 -0.1333 -0.3120 0.6418
```

```
>> rank(pp)
```

```
ans =
3
```

```
A =
```

```
-6.6667 -0.3120 0
0 0 1.0000
13.4667 0.6240 -0.1333
```

```
>> eig(A)
```

```
ans =
-6.7617
-0.0191 + 0.0761i
-0.0191 - 0.0761i
```

From these results it can be seen that the rank value of matrix P equals n matrix A making the system controllable. Value of the determinant of the matrix P is not equal to zero (0) and rank matrix P equals n matrix A indicates that the water turbine system variables can be measured. Eigenvalue indicates that the system is stable because all the roots of the characteristic equation that is left of the imaginary axis, but there is an imaginary value that indicates the frequency of oscillation occurs. To get a better response of the system is then given LQR control.

Simulation of the water turbine governor systems are open loop using simulink in matlab can be seen in Figure 2.

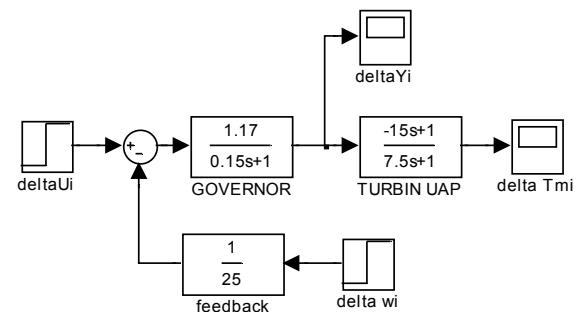


Figure 2. Block diagram of open-loop simulation of the turbine system and its settings using MATLAB Simulink

Water turbine system response can be seen in Figure 3, which happens quite dramatically undershoot and steady response at time 50s.

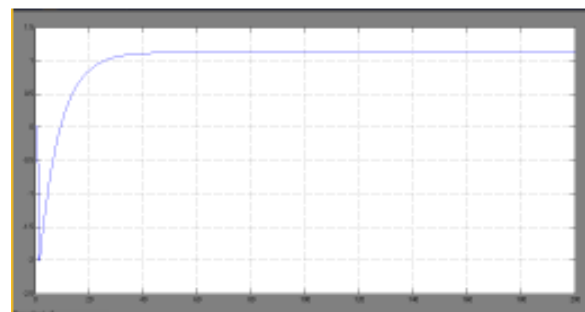


Figure 3. Open-loop response of the turbine system and its settings

Water turbine system response with LQR control can be seen in Figure 4. Where the value of Q that is used is a 3x3 matrix with all values Q = [1 1 1, 1 1 1, 1 1 1]. Figure 4 shows the shorter of undershoot and faster settling time is 32s.

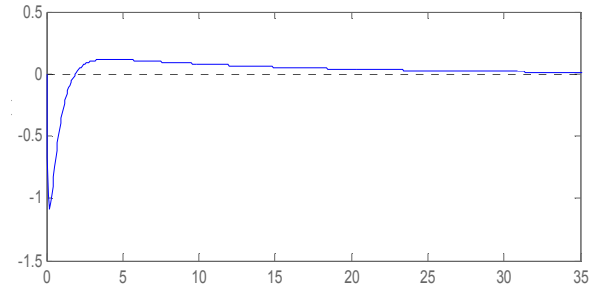


Figure 4. Turbine system response with LQR

Resulting value of K is 19.2156, 0.9608, 9.2950. Eigenvalues of above system with LQR value is -10.2300, -1.3753, -0.0740 where all values are to the left of the imaginary axis so that the system is stable. Its value is much more negative than the value before the given LQR and



there are no imaginary value so that the system is get greater damping then the response faster .

Water turbine system response with LQR control is used where the value of Q is a 3x3 matrix with all values  $Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  is shown in Figure 5 . Figure 5 shows the undershoot is shorter and faster settling time is 39.5s.

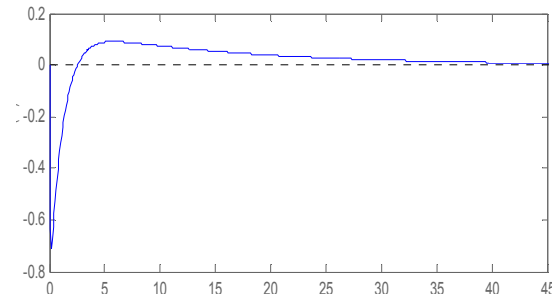


Figure 5. Turbine system response with LQR with the value of  $Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$

The resulting value of K is 20.8218 , 0.9608 , 9.5911 . Eigenvalues of above system with LQR value is -18.6871 , -0.8350 , -0.0667 where all values are to the left of the imaginary axis so that the system is stable . Its value is much more negative than the value before the given LQR and there are no imaginary value so that the system is get greater damping then the response faster . When compared with the LQR control with a value of  $Q = \begin{bmatrix} 1 & 1 & 1 \\ 1 & 1 & 1 \\ 1 & 1 & 1 \end{bmatrix}$  in Figure 5 the response is slower but has smaller undershoot.

If Q is used is a diagonal matrix the value changed from 0.2 to 0.8 you will see changes in the system's response to the increase in the value of Q. In figure 6 is a response with LQR turbine system where the value of  $Q = \begin{bmatrix} 0.2 & 0 & 0 \\ 0 & 0.2 & 0 \\ 0 & 0 & 0.2 \end{bmatrix}$

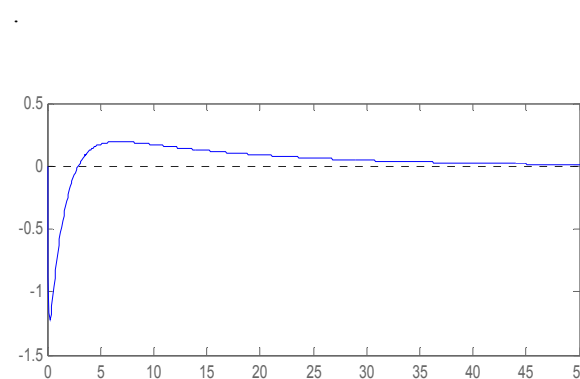


Figure 6 . Turbine system response with LQR with the value of  $Q = \begin{bmatrix} 0.2 & 0 & 0 \\ 0 & 0.2 & 0 \\ 0 & 0 & 0.2 \end{bmatrix}$

The resulting response is slower and undershoot is also greater when compared to using the  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  . For turbine system with

LQR where the value of  $Q = \begin{bmatrix} 0.4 & 0 & 0 \\ 0 & 0.4 & 0 \\ 0 & 0 & 0.4 \end{bmatrix}$  is shown in Figure 7 .

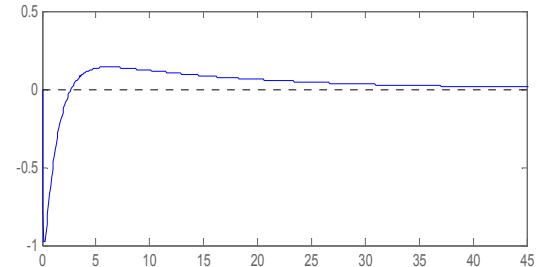


Figure 7. Turbine system response with LQR with the value of  $Q = \begin{bmatrix} 0.4 & 0 & 0 \\ 0 & 0.4 & 0 \\ 0 & 0 & 0.4 \end{bmatrix}$

The resulting response more quickly and undershoot is also greater when compared to using a  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  . For turbine system with LQR where the value of  $Q = \begin{bmatrix} 0.6 & 0 & 0 \\ 0 & 0.6 & 0 \\ 0 & 0 & 0.6 \end{bmatrix}$  is shown in Figure 8 .

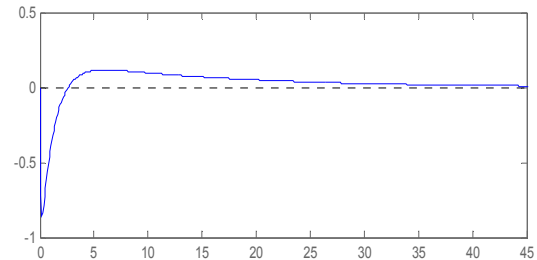


Figure 8 . Turbine system response with LQR with the value of  $Q = \begin{bmatrix} 0.6 & 0 & 0 \\ 0 & 0.6 & 0 \\ 0 & 0 & 0.6 \end{bmatrix}$

The resulting response is slower and undershoot is also greater when compared to using the  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  . For turbine system with LQR where the value of  $Q = \begin{bmatrix} 0.8 & 0 & 0 \\ 0 & 0.8 & 0 \\ 0 & 0 & 0.8 \end{bmatrix}$  is shown in Figure 9 .

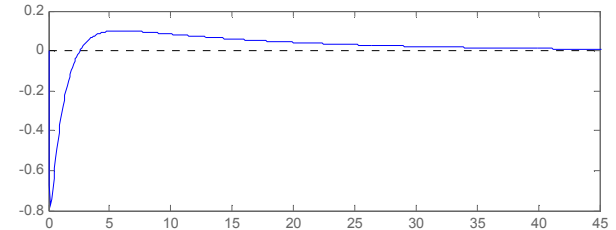


Figure 9 . Turbine system response with LQR with the value of  $Q = \begin{bmatrix} 0.8 & 0 & 0 \\ 0 & 0.8 & 0 \\ 0 & 0 & 0.8 \end{bmatrix}$

The resulting response more quickly and undershoot is also slightly larger when compared to using the  $\begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$  . K values and eigenvalues of the above experiments are shown in Table 1 .

Table 1. *Changes in response of the turbine system to changes in the value of Q on LQR*

<b>Q (matrik diagonal)</b>	<b>0,2</b>	<b>0,4</b>	<b>0,6</b>	<b>0,8</b>	<b>1</b>
<b>K</b>	9.021 0.409 4.239	12.96 0.593 6.036	15.99 0.735 7.412	18.56 0.855 8.571	20.82 0.960 9.591
<b>Eigen value</b>	- 10.300 1 - 0.6735 - 0.0673	- 12.915 3 - 0.7624 - 0.0669	- 15.085 9 - 0.8004 - 0.0668	- 16.982 1 - 0.8215 - 0.0667	- 18.687 1 - 0.8350 - 0.0667
<b>Ts</b>	45s	32s	44.3s	41.1s	39,5s
<b>undersho ot</b>	-1.2	-0.95	-0.8	-0.77	-0.7

## CONCLUSION

1. COS identification results show the system can be controlled and variables can be

measured and the system is stable but there are imaginary value which indicates the oscillation frequency.

2. Addition LQR causing the system more stable, undershoot is 1.3 smaller and 10.5 s faster response when using  $Q = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$ .
3. The increase in the value of Q on LQR cause the value of K rises and undershoot value decreases .

## References

- [1]Imam Robandi."Modern Power System Control".ANDI. Yogyakarta.2009.
- [2]Imam Robandi."Desain Sistem tenaga Modern".ANDI. Yogyakarta.2006.
- [3]Sanatang." Perbaikan Stabilitas Frekuensi Dan Tegangan Pada Beban Dinamik Sistem Selselbar Menggunakan Metode Linear Quadratic Regulator (LQR)" MEDIA ELEKTRIK, Volume 3 Number 1. 2008 .

## DESIGN OF POWER SYSTEM STABILIZER BASED FUZZY CONTROLLER WITH STATE FEEDBACK FOR SINGLE MACHINE INFINITE BUS SYSTEM

**Tamaji<sup>1</sup>, Imam Robandi<sup>2</sup>**

Email: tamajikayadi@gmail.com, robandi@ee.its.ac.id

<sup>1,2</sup> Department of Electrical Engineering, Faculty of Industrial Technology  
Sepuluh Nopember Institut of Technology, Campus ITS Sukolilo Surabaya 60111, Indonesia

### **Abstract**

*The Single Machine Infinite Bus (SMIB) is a non linear model of power system generation. The instability of SMIB is avoided by using the Power system stabilizer (PSS). The PSS is used to damp the mechanic electro oscillation in electricity power system. There are some methods of PSS control design are adaptive control, robust control, fuzzy controller and so on. Here, we design the PSS controller by using the state feedback fuzzy controller. At the first time, we build the Takagi-Sugeno fuzzy model, the second step is determining the state feedback controller based on the Routh-Hurwitz criteria, and finally we do simulation to see the performance of PSS.*

**Keywords:** SMIB, PSS, fuzzy controller, state feedback, Routh-Hurwitz.

### **INTRODUCTION**

In power system generation, power system stabilizer (PSS) is use to damp the mechanic electro oscillation. This oscillation is a disturbance of system. Some disturbances are due to continuing variation of power, changing the set point and others. Some methods of PSS design controller are direct feedback linearization (Tamaji, 2009; Yadaiah & Ramana, 2006), adaptive control and robust control beside that fuzzy logic is influence to increase the performance of PSS.

In this paper, we design the state feedback controller of single machine infinite bus (SMIB). The mathematical model of SIMB system is non linear system (Soliman, 2009; Yadaiah & Ramana, 2006). To design the controller of this PSS, at the first time, we change the mathematical model of SIMB into fuzzy model T-S, after that we define the fuzzy state feedback controller, we determine the state feedback gain base on the Routh-Hurwitz criteria, and finally we make simulation to analyze the performance of PSS.

### **SMIB Fuzzy Model**

The generating power system is a non linear system (Soliman, 2009; Yadaiah & Ramana, 2006) as follows

$$\begin{aligned}\dot{\delta} &= \omega_0 \omega \\ \dot{\omega} &= (T_m - E'_q I_q - (x_q - x'_d) I_d I_q) / M \\ \dot{E}'_q &= (-E'_q - (x_q - x'_d) I_d + E_{fd}) / T'_{d0} \\ \dot{E}'_{fd} &= \frac{K_E}{T_E} (V_{ref} - V_T + u_{pss}) - \frac{1}{T_E} E'_{fd}\end{aligned}\quad (1)$$

The state variable  $\delta$ ,  $\omega$ ,  $E'_q$ ,  $E'_{fd}$  is angle, angular velocity, induced EMF proportional to field current and generator field voltages, respectively.

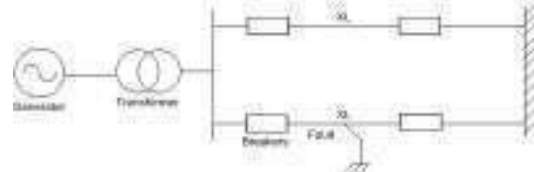


Figure 1. SMIB

Because the system is non linear and we want to build the Takagi-Sugeno fuzzy model, then we arrange Equation (1) become

$$\begin{aligned}\delta &= \omega_0 \omega \\ \dot{\omega} &= \frac{T_m}{M\delta} \delta - E'_q \frac{I_q}{M} \left[ 1 + (x_q - x'_d) \frac{I_d}{E'_q} \right] \\ \dot{E}'_q &= - \left[ \frac{1}{T'_{d0}} + (x_q - x'_d) \frac{I_d}{E'_q T'_{d0}} \right] E'_q + \frac{E_{fd}}{T'_{d0}} \\ \dot{E}'_{fd} &= \frac{K_E}{T_E E'_q} (V_{ref} - V_T) E'_q - \frac{1}{T_E} E'_{fd} + u_{pss} \frac{K_E}{T_E}\end{aligned}\quad (2)$$

We can write Equation (2) as state space system as follows:

$$\begin{bmatrix} \dot{\delta} \\ \dot{\omega} \\ \dot{E}'_q \\ \dot{E}'_{fd} \end{bmatrix} = \begin{bmatrix} 0 & \omega_0 & 0 & 0 \\ \frac{T_m}{M\delta} & 0 & -S_1 & 0 \\ 0 & 0 & -S_2 & \frac{1}{T'_{d0}} \\ 0 & 0 & S_3 & -\frac{1}{T_E} \end{bmatrix} \begin{bmatrix} \delta \\ \omega \\ E'_q \\ E'_{fd} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ \frac{K_E}{T_E} \end{bmatrix} u_{pss}\quad (3)$$

Where

$$S_1 = \frac{I_q}{M} \left[ 1 + (x_q - x_d') \frac{I_d'}{E_q'} \right]$$

$$S_2 = \left[ \frac{1}{T_{d0}'} + (x_q - x_d') \frac{I_d'}{E_q' T_{d0}'} \right]$$

$$S_3 = \frac{K_E}{T_E E_q'} (V_{ref} - V_T)$$

The state space system in Equation (3) can be written in general form

$$\dot{x} = Ax + Bu$$

Where

$$x = \begin{bmatrix} \delta & \omega & E_q' & E_{fd}' \end{bmatrix}^T;$$

$$A = \begin{bmatrix} 0 & \omega_0 & 0 & 0 \\ \frac{T_m}{M\delta} & 0 & -S_1 & 0 \\ 0 & 0 & -S_2 & \frac{1}{T_{d0}'} \\ 0 & 0 & S_3 & -\frac{1}{T_E} \end{bmatrix}$$

$$B = \begin{bmatrix} 0 & 0 & 0 & \frac{K_E}{T_E} \end{bmatrix}; u = u_{pss}$$

In this problem, the fuzzy variable are  $P, Q, X_e$ , the variable

$P$ : active power loading;  $Q$ : reactive power loading;  
 $X_e$ : equivalent tie-line reactance

where

$$P \in [P^-, P^+], Q \in [Q^-, Q^+], X_e \in [X_e^-, X_e^+]$$

such that we can derive the fuzzy rules as follows:

Rule Model 1

IF ..... $P(t)$  is... $P^-$  AND... $Q(t)$  is... $Q^-$  AND... $X_e(t)$  is... $X_e^-$

THEN ..... $\dot{x}(t) = A_1 x(t) + Bu(t)$

$$y(t) = Cx(t)$$

Rule Model 8

IF ..... $P(t)$  is... $P^+$  AND... $Q(t)$  is... $Q^+$  AND... $X_e(t)$  is... $X_e^+$

THEN ..... $\dot{x}(t) = A_8 x(t) + Bu(t)$

$$y(t) = Cx(t)$$

The member function of  $P, Q, X_e$  can be represented as figure 2.

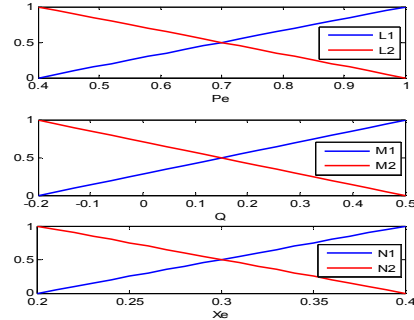


Figure 2. Member Function

If we define

$$\alpha_i = \frac{h_i}{\sum_{j=1}^8 h_j}; i = 1, 2, \dots, 8$$

After we applied the fuzzification according rule 1-8, then we applied defuzzification such as below

$$\dot{x} = \sum_{i=1}^8 \alpha_i (A_i x_i + Bu) \quad (4)$$

And the output of system is

$$y = Cx_i \quad (5)$$

## DESIGN CONTROLLER FUZZY MODEL OF SMIB

There are some design controller methods such as state feedback controller  $u = -Fx$ , and output feedback controller  $u = Fy$ , where  $y$  is output such as equation (9). In this paper we design the controller by using the state feedback controller. The state feedback fuzzy controller is constructed by PDC is

$$u(t) = -\sum_{i=1}^8 F_i x(t) \quad (6)$$

We substitute equation (6) into equation (4), we obtain

$$\dot{x} = \sum_{i=1}^8 \alpha_i (A_i x_i + BF_i x_i)$$

Or we can write as

$$\dot{x} = \sum_{i=1}^8 \alpha_i (A_i - BF_i) x_i \quad (7)$$

The problem of design controller is determining the matrix  $F_i$  such that the system in equation (7) is stable. One of methods to analyze the stability of system is by determining the eigen value of  $\alpha_i (A_i - BF_i)$ . In this paper, we analyze the eigen value of matrix  $\alpha_i (A_i - BF_i)$ . The system is stable if

the real part of eigen value is negative or lay on the left half plane of complex space.

The eigen value of matrix  $\alpha_i(A_i - BF_i)$  is obtained by solving Equation (8)

$$|\lambda I - \alpha_i(A_i - BF_i)| = 0 \quad (8)$$

The polynomial of eigen value is

$$\begin{aligned} \lambda^4 &+ \left( \frac{1}{T_E} + S_{2i} \right) \alpha_i \lambda^3 + \left( \frac{S_{2i}}{T_E} - \frac{S_{3i}}{T_{d0}'} - \frac{\omega_0 T_m}{M\delta} \right) \alpha_i^2 \lambda^2 + \\ &\alpha_i^3 \left( S_{1i} \frac{1}{T_{d0}'} \frac{K_E}{T_E} f_{i2} - \omega_0 \frac{T_m}{M\delta} \left( \frac{1}{T_E} + S_{2i} \right) \right) \lambda - \\ &\alpha_i^4 \omega_0 \frac{T_m}{M\delta} \left[ \frac{S_{2i}}{T_E} - \frac{S_{3i}}{T_{d0}'} \right] - \frac{S_{1i} \omega_0 \alpha_i^3 K_E}{T_E} f_{i1} \frac{1}{T_{d0}'} = 0 \end{aligned}$$

Furthermore, we made The Routh Hurwitz table as follows

$$\begin{array}{cccc} 1 & a_2 & a_4 & 0 \\ a_1 & a_3 & 0 & 0 \\ b_1 & a_4 & 0 & 0 \\ c_1 & 0 & & \\ a_4 & 0 & & \end{array}$$

Where

$$\begin{aligned} a_0 &= 1; a_1 = \left( \frac{1}{T_E} + S_{2i} \right) \alpha_i \\ a_2 &= \left( \frac{S_{2i}}{T_E} - \frac{S_{3i}}{T_{d0}'} - \frac{\omega_0 T_m}{M\delta} \right) \alpha_i^2 \\ a_3 &= \alpha_i^3 \left( S_{1i} \frac{1}{T_{d0}'} \frac{K_E}{T_E} f_{i2} - \omega_0 \frac{T_m}{M\delta} \left( \frac{1}{T_E} + S_{2i} \right) \right) \\ a_4 &= -\alpha_i^4 \omega_0 \frac{T_m}{M\delta} \left[ \frac{S_{2i}}{T_E} - \frac{S_{3i}}{T_{d0}'} \right] - \frac{S_{1i} \omega_0 \alpha_i^3 K_E}{T_E} f_{i1} \frac{1}{T_{d0}'} \end{aligned}$$

According the Routh-Hurwitz, system (3) is stable if

$$\begin{aligned} a_1 &> 0; \quad b_1 = \frac{a_1 a_2 - a_3}{a_1} > 0; \quad b_2 = a_4 \\ c_1 &= \frac{b_1 a_3 - a_1 b_2}{b_1} > 0; \quad c_2 = 0 \end{aligned} \quad (9)$$

$$d_2 = \frac{c_1 b_2 - 0}{c_1} = a_4 > 0$$

By calculating and arranging Equation (9) then we get this system is stable if the state feedback gain  $F_i = [f_{i1} \quad f_{i2}]$  satisfy

$$\begin{aligned} f_{i2} &> \omega_0 \frac{T_m}{M\delta} (1 + S_{2i} T_E) \frac{T_{d0}'}{S_{1i} K_E} \\ f_{i1} &< \frac{T_m}{S_{1i} K_E M\delta} [-T_{d0}' S_{2i} + T_E S_{3i}] \end{aligned} \quad (10)$$

The state feedback gain will be substituted to Equation (6) to obtain the input controller and the performance of PSS will be obtained by substituting Equation (10) to Equation (7).

## RESULT AND DISCUSSION

Suppose, there are two states which can measured such as  $\delta$  and  $\omega$ . The state feedback gain  $F_i = [f_{i1} \quad f_{i2}]$  will be chosen such that Equation (14) is satisfied. Suppose

$$f_1^* = \frac{T_m}{S_{1i} K_E M\delta} [-T_{d0}' S_{2i} + T_E S_{3i}] \quad \text{and}$$

$$f_2^* = \omega_0 \frac{T_m}{M\delta} (1 + S_{2i} T_E) \frac{T_{d0}'}{S_{1i} K_E} \quad \text{then we choose}$$

$$F_i = [f_{i1} \quad f_{i2}] \text{ such that } f_{i1} < f_1^* \text{ and } f_{i2} > f_2^*.$$

In this simulation we take the initial condition

$$\delta_0 = 0.2; \omega_0 = 377; E_{q0} = 0.2; E_{fd0} = 0.1$$

The parameters are (yadaiah)

$$x_q = 1.7; x_d = 1.8; x_d' = 0.3; T_d' = 8; M = 13$$

$$V_\infty = 1; K_E = 200; T_E = 0.001; T_{d0} = 8; x_{de} = 0.1$$

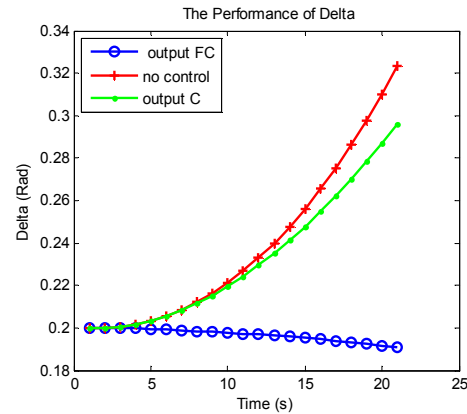


Figure 3. The Performance of  $\delta$

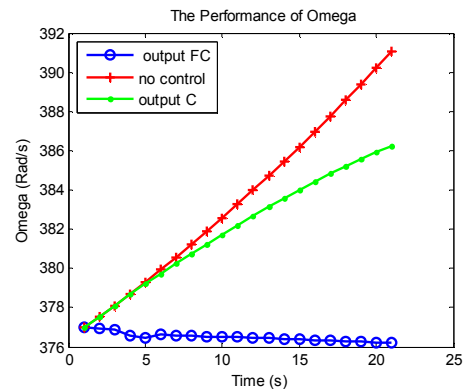


Figure 4. The Performance of  $\omega$

Figure 3 and figure 4 state the performance of  $\delta$ ,  $\omega$  respectively. The performance of  $\delta$ ,  $\omega$  are divergence for SIMB system without control and SIMB system with control without fuzzy. But the performance of  $\delta$ ,  $\omega$  for SIMB system with fuzzy control are converge. So, it is important to design fuzzy control for this SIMB.

At first time we choose state feedback gain  $f_{1i} = 0.6f_1^*$  and  $f_{2i} = 1.4f_2^*$  for system with state feedback fuzzy control. The performance of  $\delta$ ,  $\omega$ ,  $P_e$ ,  $Q$  are state in figure 5. The magnitudes of  $\delta$ ,  $\omega$  are decrease, and the magnitudes of  $P_e$ ,  $Q$  are converge.

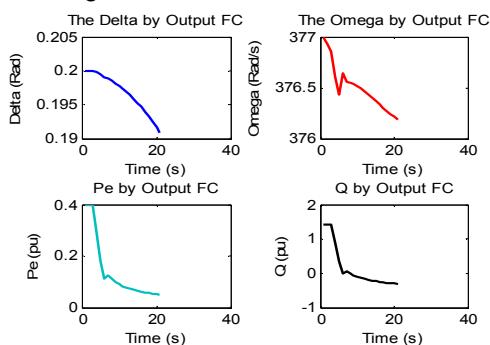


Figure 5.  $f_{1i} = 0.6f_1^*$ ;  $f_{2i} = 1.4f_2^*$

We also did simulation with difference initial condition such as  $\delta_0 = 0.9$ ;  $\omega_0 = 200$ , the performance SMIB represent on figure 6-9 as below

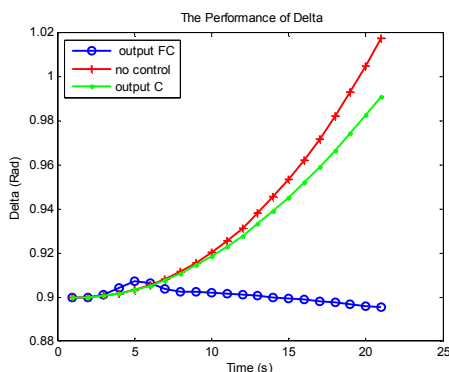


Figure 6 The performance of  $\delta$

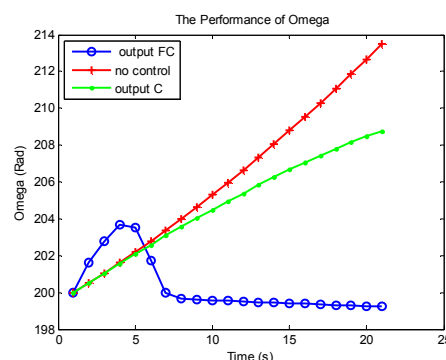


Figure 7. The Performance of  $\omega$

From figure 6-9, we see that the performance of SIMB without control and with state control without fuzzy are divergence, but the performance of SIMB with state fuzzy control is converge. Some simulation result with difference value of state feedback gain are represented in figure 8-9.

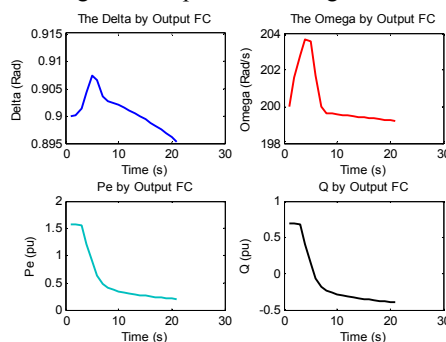


Figure 8.  $f_{1i} = 0.6f_1^*$ ;  $f_{2i} = 1.4f_2^*$ ;  
 $\delta_0 = 0.9$ ;  $\omega_0 = 200$

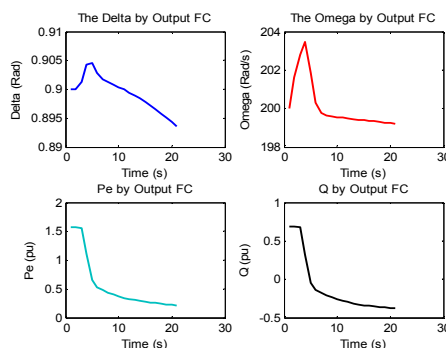


Figure 9.  $f_{1i} = 3f_1^*$ ;  $f_{2i} = -f_2^*$ ;  
 $\delta_0 = 0.9$ ;  $\omega_0 = 200$

Figure 6-9 state that the performance of SIMB state feedback fuzzy control are good for other initial condition.

From those simulations, we know that the design controller by using the fuzzy state feedback controller give the stable performance of  $\delta$ ,  $\omega$ . The performances are depend on value of state feedback gain but not depend on initial condition of  $\delta_0$ ,  $\omega_0$ .

## CONCLUSION

In this paper we discuss about the designing controller based of fuzzy state feedback controller. The state feedback gain is determined by using Routh Hurwitz criteria. From the analyze and simulation we conclude that

- The state feedback controller (without fuzzy) can't be applied as design controller
- The fuzzy state feedback can be used to design controller of SMIB
- The fuzzy state feedback is independent from the initial condition, but dependent on the value of state feedback gain

- The value of state feedback gain are available for certain interval.

## References

- [1] Soliman, M, Elshafei, Bendary, F. and Mansour, W, 2009, LMI static Output Feedback design of fuzzy power system stabilizers, Expert systems with Application 36 pp. 6817-6825, Elsevier.
- [2] Tamaji, Musyafa, Darma A and Robandi, I, 2009, Controller Design SMIB by Direct Feedback linearization, presented in Conference APTECS 2009, ITS, Surabaya, Indonesia.
- [3] Yadaiah, N, Ramana, N.Y., 2006, Linearization of Multi machine Power System: modeling and Control.
- [4] Peng zhao and O.P. Malik, 2009, Design of an Adaptive PSS Based on Recurrent Adaptive Control Theory.
- [5] Ogata, K., 1997, Modern Control Engineering, Prentice Hall.

## STABILITY ANALYSIS OF A POWER SYSTEM MODELING 2 AREA IN THE FORM OF STATE SPACE

**Abil Huda, Riski C. A. H., Akhmad Ramdhani and Imam Robandi**

Jurusan Teknik Elektro – FTI, Institut Teknologi Sepuluh Nopember Surabaya  
Kampus ITS, Keputih – Sukolilo, Surabaya 60111

### Abstract

*COS (Controlability, Observability & Stability) are methods for analyzing a system that can be controlled, observed and stable. This analysis is a system requirement that must be met prior to setting design. Two areas of power system is a system consisting of two connected areas where each area has a governor and turbine control components with output speed and rotor angle. State Space modeling system is a matrix in the form of mathematical equations formed from a plant or system used to control a system problem resolution.*

### INTRODUCTION

To date the development of the electric power system has been growing very rapidly. This is due to the needs of society or the consumer of electricity in developed regions continue to grow

along with the times. Therefore, to meet these needs, the power system must be able to provide optimal performance in serving the public or consumers of electricity. Optimization of power system becomes a common problem that must be solved in order to improve power distribution listrik performance in serving the public or consumers of electricity. Various methods performed to obtain the performance of optimal power system both in terms of operation and control. One way is to control the parameters of state space modeling system which is in the form of a matrix formed from mathematical equations derived from an electric power system.

The stability of the power system to ensure the continuity and reliability of the distribution. Stable electric power system will facilitate control in order to produce optimal system.

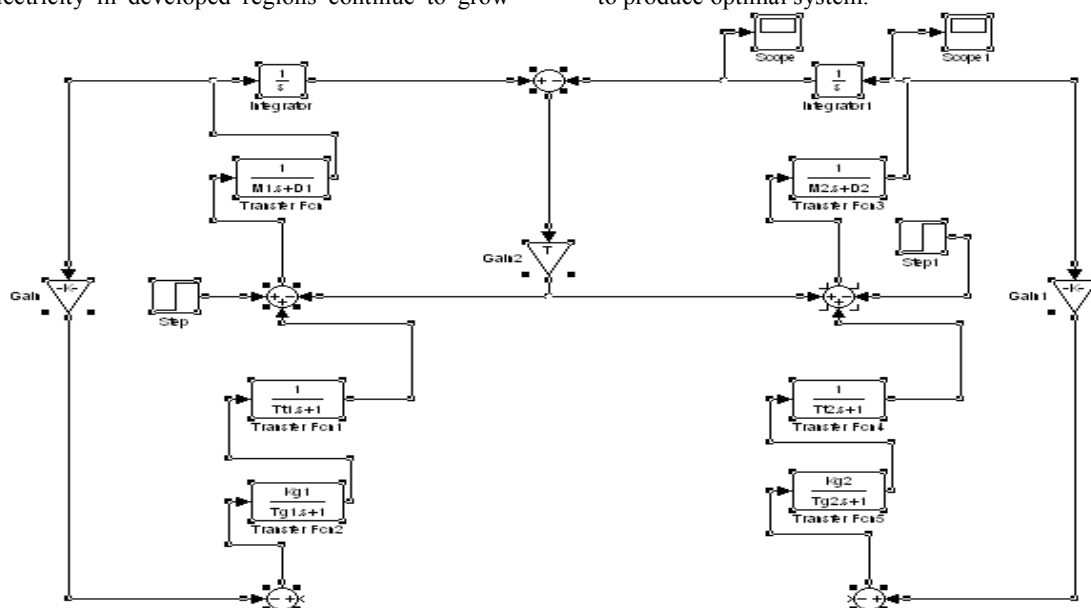


Figure1. PowerSystemBlock Diagram2Area



## METHOD

### Model Two Area Power System

Equation Governor Area 1 & 2

$$\Delta \dot{Y}_1 = \frac{K_{G1}}{T_{g1}} \Delta u_1 - \frac{K_{G1}}{R_1 T_{G1}} \omega_1 - \frac{1}{T_{G1}} \Delta Y_1 \quad (1)$$

$$\Delta \dot{Y}_2 = \frac{K_{G2}}{T_{g2}} \Delta u_2 - \frac{K_{G2}}{R_2 T_{G2}} \omega_2 - \frac{1}{T_{G2}} \Delta Y_2 \quad (2)$$

Equation Turbine Area 1 & 2

$$\Delta \dot{P}_{m1} = \frac{1}{T_{T1}} \Delta Y_1 - \frac{1}{T_{T1}} \Delta P_{m1} \quad (3)$$

$$\Delta \dot{P}_{m2} = \frac{1}{T_{T2}} \Delta Y_2 - \frac{1}{T_{T2}} \Delta P_{m2} \quad (4)$$

Speed equation Areas 1 & 2

$$\Delta \dot{\omega}_1 = \left( \frac{1}{M_1} \right) \Delta P_{m1} - \left( \frac{D_1}{M_1} \right) \Delta \omega_1 - \left( \frac{T}{M_1} \right) \Delta \delta_1 + \left( \frac{T}{M_1} \right) \Delta \delta_2 \quad (5)$$

$$\Delta \dot{\omega}_2 = \left( \frac{1}{M_2} \right) \Delta P_{m2} - \left( \frac{D_2}{M_2} \right) \Delta \omega_2 + \left( \frac{T}{M_2} \right) \Delta \delta_1 - \left( \frac{T}{M_2} \right) \Delta \delta_2 \quad (6)$$

Equation Angle Rotor Area 1 & 2

$$\Delta \dot{\delta}_1 = \Delta \omega_1 \quad (7)$$

$$\Delta \dot{\delta}_2 = \Delta \omega_2 \quad (8)$$

### State Space

Simple system

$$\dot{x} = Ax + Bu \quad (9)$$

$$y = Cx \quad (10)$$

$x$  = matrix system state variables (n x 1)

$u$  = matrix system input variables (r x 1)

$y$  = output variable matrix (m x 1)

$A$  = system matrix (n x n)

$B$  = matrix (n x r)

$C$  = Measurement matrix (m x n)

### COS (Controlability, Observability & Stability)

#### 1. Controlability

$$P = [B : AB : A^2B : \dots : A^{(n-1)}B]$$

The system can be controlled if the matrix Phasrank = n.

#### 2. Observability

$$P = [C^T : A^T C^T : (A^T)^2 C^T : \dots : (C^T)^{(n-1)} A^T C^T]$$

The system is observable if the matrix Phasrank = n.

#### 3. Stability

Characteristic eigenvalues

$$a_0 \lambda^n + a_1 \lambda^{n-1} + a_2 \lambda^{n-2} + \dots + a_{n-1} \lambda + a_n = 0$$

The system is stable if the roots of the characteristic equation are on the left of the imaginary axis.

## RESULTS AND ANALYSIS

State Space Matrix Two Area Power System:

$$\begin{bmatrix} \Delta \dot{Y}_1 \\ \Delta \dot{Y}_2 \\ \Delta \dot{P}_{m1} \\ \Delta \dot{P}_{m2} \\ \Delta \dot{\omega}_1 \\ \Delta \dot{\omega}_2 \\ \Delta \dot{\delta}_1 \\ \Delta \dot{\delta}_2 \end{bmatrix} = \begin{bmatrix} \frac{1}{T_{g1}} & 0 & 0 & 0 & \frac{K_{g1}}{R_1 T_{g1}} & 0 & 0 & 0 \\ 0 & \frac{1}{T_{g2}} & 0 & 0 & \frac{K_{g2}}{R_2 T_{g2}} & 0 & 0 & 0 \\ 1 & 0 & \frac{1}{T_{T1}} & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & \frac{1}{T_{T2}} & 0 & 0 & 0 & 0 \\ 0 & 0 & \frac{1}{M_1} & 0 & \frac{D_1}{M_1} & 0 & \frac{T}{M_1} & 0 \\ 0 & 0 & 0 & \frac{1}{M_2} & 0 & \frac{D_2}{M_2} & 0 & \frac{T}{M_2} \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} \Delta Y_1 \\ \Delta Y_2 \\ \Delta P_{m1} \\ \Delta P_{m2} \\ \Delta \omega_1 \\ \Delta \omega_2 \\ \Delta \delta_1 \\ \Delta \delta_2 \end{bmatrix} + \begin{bmatrix} \frac{K_{g1}}{T_{g1}} & 0 \\ 0 & \frac{K_{g2}}{T_{g2}} \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \\ 0 & 0 \end{bmatrix} \begin{bmatrix} \Delta u_1 \\ \Delta u_2 \end{bmatrix}$$

Matrix computations using MATLAB software.

$$T_{G1} = 6, \quad T_{G2} = 8$$

$$K_{G1} = 1, \quad K_{G2} = 4$$

$$R_1 = 2, \quad R_2 = 1$$

$$T_1 = 4, \quad T_2 = 5$$

$$M_1 = 4, \quad M_2 = 3$$

$$D_1 = 3, \quad D_2 = 3, \quad T = 1$$

$$\gg A = [-1/6 \ 0 \ 0 \ 0 \ -1/12 \ 0 \ 0 \ 0; 0 \ -1/8 \ 0 \ 0 \ 0 \ -2/4 \ 0 \ 0; 1/4 \ 0 \ -1/4 \ 0 \ 0 \ 0 \ 0 \ 0; 0 \ 1/5 \ 0 \ -1/5 \ 0 \ 0 \ 0 \ 0; 0 \ 0 \ 1/4 \ 0 \ -3/4 \ 0 \ -1/4 \ 1/4; 0 \ 0 \ 0 \ 1/3 \ 0 \ -3/3 \ 1/3 \ -1/3; 0 \ 0 \ 0 \ 0 \ 1 \ 0 \ 0 \ 0; 0 \ 0 \ 0 \ 0 \ 0 \ 1 \ 0 \ 0];$$

$$\gg B = [1/6 \ 0; 0 \ 2/8; 0 \ 0; 0 \ 0; 0 \ 0; 0 \ 0; 0 \ 0];$$

$$\gg C = [1 \ 2 \ 3 \ 4 \ 5 \ 6 \ 7 \ 8];$$

### Controllable:

n = 8, then:

$$P = [B : AB : A^2B : A^3B : A^4B : A^5B : A^6B : A^7B]$$

$$\gg \text{rank}(P)$$

$$\text{ans} =$$

$$8$$

Rank P = 8, then the system Controllable

### Observable:

n = 8, then:

$$P = [C^T : A^T C^T : A^{T^2} C^T : A^{T^3} C^T : A^{T^4} C^T : A^{T^5} C^T : A^{T^6} C^T : A^{T^7} C^T]$$

$$\gg \text{rank}(P)$$

$$\text{ans} =$$

$$8$$

Rank P = 8 then the system observable

### Stability:

$$\gg \text{eig}(A)$$

$$\text{ans} =$$

$$-0.9225$$

$$-0.4093 + 0.6164i$$

$$-0.4093 - 0.6164i$$

$$-0.2928$$

$$-0.1633 + 0.1427i$$

$$-0.1633 - 0.1427i$$

-0.0000  
-0.1310

Eigenvalues of the value above which there is no value located to the right of the imaginary axis so that the system is stable.

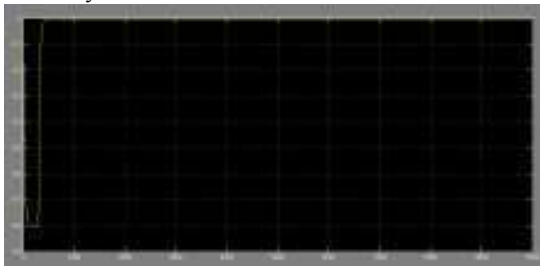


Figure 2. State Respon System

## CONCLUSION

After analyzing COS (controlability, Observability & Stability) two area power system with these parameters it can be concluded that the system can be in control, observation and stable.

## Reference

- Imam Robandi, *Modern Power System Control: Desain, Analisis & Solusi Kontrol Tenaga Listrik*, ANDI Publisher, 2006.
- Katsuhiko Ogata, *State Space Analysis of Control System*, Prentice Hall, Upper Saddle River, New Jersey, 2002.
- Katsuhiko Ogata, *Modern Control Engineering Third Edition*, Prentice Hall, Upper Saddle River, New Jersey, 1997.

## ANALYSIS OF POWER SYSTEM STABILIZER (PSS) PERFORMANCE ON SINGLE MACHINE INFINITE BUS (SMIB) USING PARTICLE SWARM OPTIMIZATION (PSO) ALGORITHM

Hidayatul Nurohmah<sup>1)</sup>, Nita Indriani Pertiwi<sup>2)</sup>, Hilmansyah<sup>3)</sup>,  
Andi Imran<sup>4)</sup>, Imam Robandi<sup>5)</sup>

<sup>1),2),4),5)</sup>Department of Electrical Engineering, Faculty of Industrial Technology,  
ITS, Kampus ITS Sukolilo, Surabaya 60111, Indonesia.

<sup>3)</sup>Politeknik Negeri Balikpapan

<sup>1)</sup>hidayatul.nurohmah13@mhs.ee.its.ac.id; <sup>5)</sup>robandi@ee.its.ac.id

### Abstract

*This paper discuss the use of Power System Stabilizer (PSS) on Single Machine Infinite Bus (SMIB) which tuned by Particle Swarm Optimiazation (PSO)algorithm by using MATLAB software. Response which tuned by PSO, can lower the oscillation and repair the stability with condition overload when fault happen. The dynamic changes in power system is enable always cause oscillation inpower system. Torepair theoscillation inpower system, need PSS instrument on SMIB tuned by PSO, so the frequency and voltage stability can be better. PSS on SMIB can repair stability andlower the overshoot value andsettling time. From simulation gain a better result using PSS than using SMIB without PSS and tuned by PSO.*

**Keywords:** PSS, SMIB, PSO

### INTRODUCTION

Stability is a very important thing on power system. There are two kind of stability on power system that is the steady state stability and the transient stability. The fault on power system enable always get frequency oscillation. To see the system is normal or not after get fault, need some observation asstability indicator when get fault, small either big fault. Big either small fault that happen very influenceto system stability. To repair the oscillation on power system can usePSS instrumenton SMIB with PSO optimazation which useful to raise the limit of system stability and can lower the oscillation. PSS have an input signal which lower overshoot value from rotor speed, electric power, or combine variabel. The purpose of using PSS is to lower the oscillation when fault happen<sup>[1,2,3]</sup>.

In bad condition, PSS can used to frequency oscillation damping. PSS be a standard choice to posted with modern static exciter which must used

with effective on system large -scale. PSS ordinary placed on system excitation and con automatic voltage controller/ Automatic Voltage Regulator (AVR). PSS is tools which produce signal control to diumpank on system exitasion which the function focus on analysis performances voltage system. PSS can plus limit the stability with control exitation to get down the osilasi. PSS also can control terminal voltage and frequency on generator.

SMIB is a system where space between the engine with load very far in the transmission line so voltage on bus can get definition asi price which not constant.

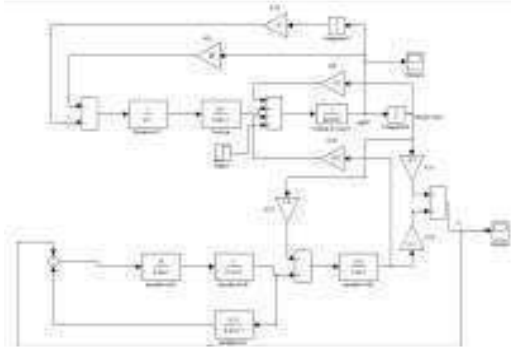
PSO is algorithm which inspired by a setof behaviors birds on searching the food. On searching the food that, the bird position move from one place to other place. Every bird have different line on finding the place of food. Bird which have the short line, will be the example other bird on finding the food. The application bird on PSO is which finding the best value from the kind of candidat solution. On algortima PSO, The best value gived name with fitness value. Thats ofbehavioral fitness value which give symbols as the short line to finding the food centre.

### MODELING SYSTEM

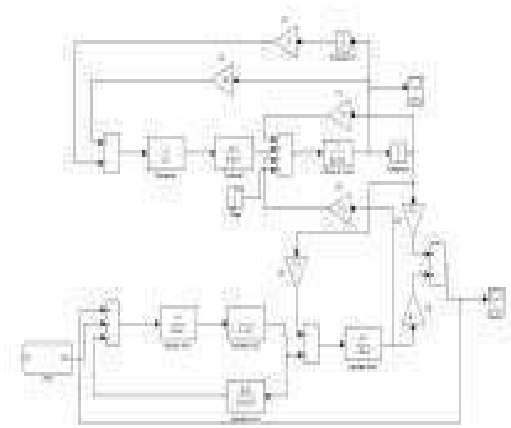
Style which used to on writing paper this based on analysis performances PSS get down to oscillation on SMIB tuned use PSO before and after use PSS. Experiment do with distination to down the oscillation with control frequency and load. Problems that occur that because change load can make oscillation. To overcome prooccurblems oscillation on load changer PSS on SMIB tuned by using PSO. Experiments do used equipment with give algorithm PSO which used to give value good parameter to so that PSS can minus the oscillation frequency with result of the more better. So that voltage and frequency on system get normal.

## ANALYSIS RESULT

To SMIB system with style of modification transfer function can determined from diagram block on picture 1.



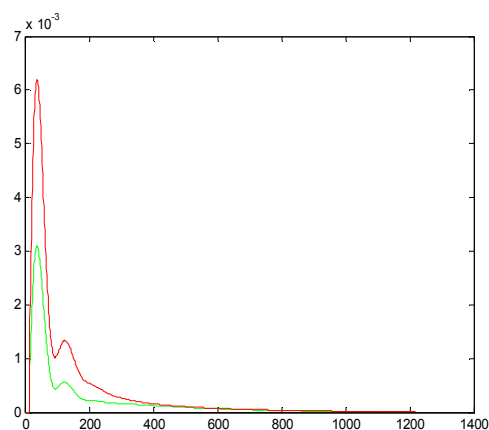
Picture 1. SMIB system model without PSS



Picture 2. SMIB system model with PSS



Picture 3. PSS model tuned PSO



Picture 4. Respons SMIB system with PSS



Picture 5. SMIB system response with PSS tuned with PSO

From simulation result on picture for can looking the red color shown that before use PSS *overshoot* more taller than with green color which shown that after using PSS the oscillation is minus. This is proved that PSS can make the oscillation down. From value simulation with using PSO to tuning PSS if differences not use PSS or with PSS, got value response system which normal more fast after get problem.

Error that occur on system also different. The differences between system not use PSS, with use PSS, and use PSS tuned using PSO is system using PSS and PSO serta *error* more to sistem with PSS and have only use PSS. On that simulation, PSO can worked with better so that got parameter value which better. parameter value mentioned entered on block PSS diagram.

## CONCLUSION

PSS on SMIB tuned by PSO algorithm can raise the stability. Lower response value and settling time shown on graph from simulation. To repair the oscillation problem on power system, need some PSS instrument on SMIB then tuned by PSO.

From simulation result gain better result by using PSS than SMIB without PSS tuned by PSO.

## Reference

- Imam Robandi, Desain sistem tenaga modern: *Fuzzy Logic, Optimization, Genetic Algorithm*, ANDI Publisher, 2006.
- P.M. Anderson & A.A. Fouad, *Power System Control and Stability*, The Iowa State University Press, 1977.
- Praba Kundur, *Power System Stability and Control*, New York: Mc. Graw-Hill, Inc. 1994.

## DESIGN AND DEVELOPMENT OF A BUILDING ENERGY AUDIT SOFTWARE

**Rini Nur Hasanah, Hadi Suyono, Wijono, and Moch Dhofir**

Electrical Engineering Department, Brawijaya University

Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Corresponding email: rini.hasanah@ub.ac.id, cell-phone:081334510268

### **Abstract**

*This article describes the design and development of a software being purposed to help in analyzing energy audit data of a building. Mastering the programming language to be used, knowing audit data parameters as well as their computation procedures, and also logical analysis and criticism to the results of program codes execution are required to the success of the task. Visual C++ is used as the programming language under Visual Studio Integrated Development Environment (IDE) of Microsoft. Data of four categories of buildings are used, representing university, religious, junior high school, and kindergarten buildings. Results show that using the chosen programming language and development environment, instruction codes should be grouped as declaration files containing the definition of variables and prototypes names to be used, and implementation files containing the detail instructions to execute. The average execution time of the program is relatively fast, with a plausible tendency to become longer when the available data amount to process is larger. The resulted practical software will generally be useful to facilitate the analysis of a building energy audit data, because it covers most measures and analyses to be performed in an energy audit. Moreover, it can also be useful to give an understanding on how energy is used in buildings as well as how to identify opportunities to reduce energy consumption and to help in contributing to energy conservation efforts.*

**Keywords:** energy audit, software, energy conservation

### **THE NEED OF ENERGY AUDIT**

Indonesia is a country with large potential of energy resources, but its people's access to energy is still limited. Therefore, the concern of sustainable development must always be borne in mind when taking decision and policy concerning national energy and natural resources management.

In 2011, the president of the Republic of Indonesia issued a legal instruction to save water

and energy. In 2012, the Minister of Energy and Mineral Resources issued two regulations, the one dealing with Electrical Energy Saving whereas the other with Management.

Ministry of Energy and Mineral Resources of the Republic of Indonesia enacted all users of energy and energy sources with consumption of energy in all forms greater than or equal to 6000 tonnes of oil equivalent (ToE), or equivalent to 69780 megawatt-hour (MWh) per year, to undertake energy conservation through energy management.

The energy conservation should be done by assigning an energy management, preparing energy conservation programs, carrying out regular energy audits, implementing recommendations resulted from energy audit, and reporting the implementation of energy conservation annually to the Minister, Governor, or Regent/Mayor in accordance with their respective authorities (PP RI, 2009).

Energy audits become a very important activity in any energy management strategy. It is stated that energy management must be done by a competent and certified person, and that the audit on the main energy utilization must be conducted on a regular basis at least once every three years.

Meanwhile, the number of certified auditors is still limited compared to the number of buildings to be audited. Audits cost is also expensive, especially if it is desirable to obtain a certified audit results. For organizations/ institutions/ large industry with consumption of energy/energy sources exceeding 6000 ToE, which are obliged to conduct energy management and conservation, the audit cost may not be a big problem compared to the possibility of savings that can be obtained, but for users of energy/energy sources less than 6000 ToE which are not required to perform the conservation measures, the audit cost could become a considerable amount being compared to the potential savings to get.

In this paper the design and development of an energy audit software is described. The use of software is expected to ease the process of

calculation and analysis of the possible energy waste, thus allowing to obtain the information about the energy consumption in a building becoming the audit object, possible waste of resources, and the selection of alternative recommendations to be implemented so that the waste can be reduced or even eliminated. Its use will also be able to reduce the required time and cost of the audit. Furthermore, the results can be used in the implementation of energy management, i.e. the planning of energy conservation program, as well as to increase awareness of users and operators of energy/energy source.

The specific objective of this paper is to describe the design of energy audit parameters algorithm, then its implementation using Visual Studio/Visual C++, to result in an energy audit tool in the form of practical software that is easy to use and interactive for users, so it does not require its use by someone who is already an expert and experienced.

#### **ENERGY AUDIT SOFTWARE**

In an energy management, to reduce the negative impact of limited generation and transmission capacity, the efforts can be directed to the improvement of efficiency on the load side, known as Demand Side Management (Merwe et al., 2011). In practice, an in depth audit of all electrical equipments used is necessary.

Energy audits become a very important activity in any energy management strategy. As a consequence, the methodology associated with the improvement of efficiency also becomes very important. However, manual methodologies generally take a long time, more error-prone, and require highly skilled personnel actors (Merwe et al., 2011). Special technical expertise is needed to enable one to perform an audit on a building efficiently (Prudenzi et al., 2008).

Accordingly, some researchers have proposed various methods and auditing tools. Merwe et al. (2011) proposed an energy audit tool development to improve the audit process using the methodology for calculating the energy usage profiles at various loads, as well as comparing it to theoretical result.

IEEE Standard 739-1995 can be used as a technical manual in the implementation of energy conservation. This standard provides procedures and techniques that enable the optimization of efficiency in the design and use of any electrical system, taking into account all the aspects (safety, cost, environment, management needs, and so on).

A energy audits software tool was proposed by Prudenzi et al. (2008). The software is designed

and implemented in order to support every step in the implementation of a complete and thorough audit with a focus on energy use in buildings.

Maricar et al. (2005) proposed the use of a web-based application for data mining models for the audit process in the industry.

Computational tools proved to be a valuable asset in the field of engineering. Melki, et al. (2009) proposed to design and build a software that allows for the simulation and analysis of energy use in a building.

Based on the experience already gained by the authors as well as the results of researches previously described, it is known that there are not many energy audit software tools which are specifically dedicated to the type of load as well as standards and regulations applicable in Indonesia. Therefore it is purposed in this paper to describe such kind of audit tool. Started with the design of algorithms for an energy audit, followed with the development of the algorithms to results in a software tool, it is tested using the data obtained from the previous audit experience of the authors.

In the future the software tool can be extended to consider more higher level of complexity of energy/energy sources as well as greater utilization capacity of energy/energy sources.

#### **DESIGN AND DEVELOPMENT METHODOLOGY**

To design and develop an energy audit software, it is necessary to master the following aspects thoroughly, i.e.

- the programming language to be used
- the audit data parameters of a building as well as their computational procedures
- logical analysis and criticism to the results of program running.

It begins with the design of algorithms, being followed with its implementation, and then the testing.

The algorithms design is based on several alternative sequence of steps that could be undertaken in the implementation of a detailed energy audit, as well as tested using data from the audit as ever conducted by the authors at multiple institutions/government agencies. So, it becomes imperative to understand and to know the audit process on each system in a building (Thumann et al., 2007).

In general, the audit software includes some blocks that represent the user, output, and also database and data processing blocks. These blocks can be classified into three layers, i.e. presentation layers, business layer, and data layer.

Presentation layer becomes the interface between the business layer and the user. In this layer user can entry some input data, as well as retrieve some output data resulted from the business layer.

The business layer contains the engines used to process data located in the data layer. The engines constitute 'the brain' of the software. It is in these engines where all definitions of audit parameters and the procedures to compute them are intertwined to process the data located in the data layer.

In the research the results of which are presented in this article, Microsoft Visual Studio, an integrated development environment (IDE) from Microsoft, has been used to develop console and graphical user interface of this application. The programming language used is Visual C++ which is also supported by Visual Studio.

A set of code files and other resources which are used to build an application is called as solution in Visual Studio. The files in a solution are arranged hierarchically, which might or might not reflect the organization in the file system. The *Solution Explorer*, as can be seen in Fig. 1, is used to manage and browse the files in a solution. It provides with an organized view of projects and their files as well as ready access to the commands that pertain to them.

Two folders mainly used to write the source codes of application are the Header Files and Source Files. All files in the Header Files folder have an.h suffix, identifying them as header files, whereas in the Source Files folder the files possess a.cpp suffix, even though both of those qualify as source code. A.cpp file is commonly called as an "implementation file", whereas a header file is called as a "declaration file". The main reason would be for separating the interface from the implementation. The header declares "what" a class (or whatever is being implemented) will do, while the cpp file defines "how" it will perform those features.

The separation reduces dependencies so that code that uses the header doesn't necessarily need to know all the details of the implementation and any other classes/headers needed only for that. This will reduce compilation times and also the amount of recompilation needed when something in the implementation changes.

A.cpp file includes the definitions from any header which it includes (because.cpp and header file together become a single 'translation unit'). A header file might be included by more than one.cpp file. The linker typically won't like anything defined in more than one.cpp file. Therefore any definitions in a header file should be inline or static. Header files also contain declarations which are used by more than one.cpp file.

Definitions that are neither static nor inline are placed in.cpp files. Also, any declarations that are only needed within one.cpp file are often placed within that.cpp file itself, instead of in any (sharable) header file.

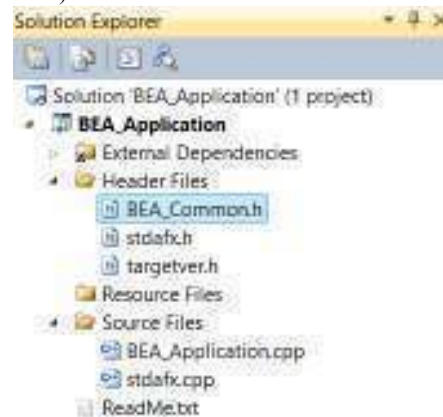


Fig. 1. *Solution Explorer* of Microsoft Visual Studio

## RESULTS AND DISCUSSION

Some declarations and definitions are put in the Header Files, an example which is shown in Fig.2, BEA\_common.h. The source codes in this folder are aimed at defining global variables and the name of prototype functions. Header Files contain information that defines the fundamental Visual C++ codes the project relies on. The files in this folder along with the.dll files will be supplied to the executable files.

As can be seen from Fig. 2, there are no further detailed procedures describe in the source codes. In Fig. 3, some function definitions are shown, the procedures of which are detailed in the source codes in the Source Files folder. In Fig. 4, the detailed procedure on how to calculate the building area is presented. It is more detailed than just the definition of function in Fig. 3.

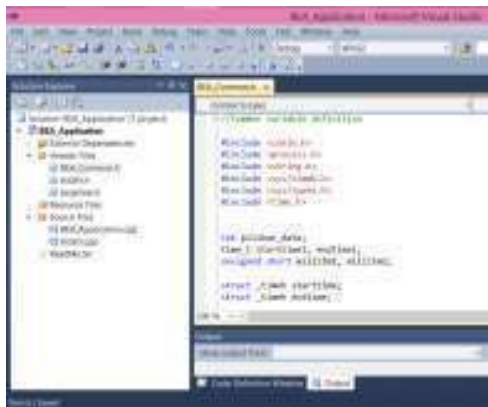


Fig. 2. Display of file source code in the Header Files folder

The whole required functions are to be run in the main program, as can be seen in Fig. 5. Using four representative buildings, the data to be processed are classified into four choices of data that must be chosen by the user.

```
//Function's Definition:
void Input_Data(void); //inputting data
void Klasifikasi_Gedung(void); //determining classification of building
void Display_Data(void); //displaying data
void Hitung_Rekening(void); //calculating bill
void Display_Hitung_Rekening(void); //displaying results of bill calculation
void Hitung_Luas_Gedung(void); //calculating building area
void Display_Luas_Gedung(void); //displaying result of building area calculation
void Hitung_IRPE(void); //calculating ECI of building
void Display_Hitung_IRPE(void); //displaying result of building ECI calculation
```

Fig. 3. Example of global variable definitions and the name of prototypes in Header Files

```
void Hitung_Luas_Gedung(void)
{
    //Calculating the area and volume of the building
    tot_L_gedung = 0.0; //total building area
    tot_V_gedung = 0.0; //total building volume

    for(int i = 1; i<=tot_Lantai; i++){
        L_gedung[i] = p_gedung[i]*l_gedung[i];
        V_gedung[i] = p_gedung[i]*l_gedung[i]*t_gedung[i];
        tot_L_gedung = tot_L_gedung + L_gedung[i];
        tot_V_gedung = tot_V_gedung + V_gedung[i];
    }
}
```

Fig. 4. Source code in the Source Files folder

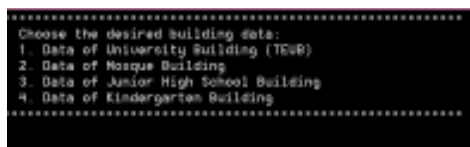


Fig. 5. Running the.cpp file, displaying Choice of building data to process

Fig. 6 and 7 show the example of results of program running. Fig. 6 is the result when the data are taken from the university building sample (Case 1), whereas in Fig. 7 the data are from the Case 4

(Kindergarten building). The calculation results of buildings area are presented. This results are obtained from the execution of the related procedures detailed in.cpp files, with definitions and functions which are declared in the header files.

```
Calculation of Building Area and Volume
-----
| Floor # | L (m) | W (m) | H (m) | A (m2) | Vol (m3) |
-----
| 1 | 15.00 | 10.00 | 10.00 | 150.00 | 600.00 |
| 2 | 12.00 | 10.00 | 10.00 | 120.00 | 540.00 |
-----
| Total | 270.00 m2 | 1140.00 m3 |
-----

ECI and IRPE of Building
-----
Total kWh of Building : 32355.00 (kwh)
Total Rp of bill of Building : 52815078.00 (Rp)
Total Building Area : 270.00 (m2)
ECI of building : 1457.63 (kWh/m2)
IRPE of building : 1560114.00 (Rp/m2)
Standard of Minimum ECI : 210.00 (kWh/m2/th)
Standard of Maximum ECI : 285.00 (kWh/m2/th)
Saving ECI Minimum : 1247.63 (kWh/m2/th)
Saving ECI Maximum : 1172.63 (kWh/m2/th)

Start Milliseconds: 233
End Milliseconds: 631
Milliseconds Execution Time: 398
```

Fig. 6. Results of program running for Case 1

A part of the results shown in Fig. 6 and 7 gives the calculation results of area and volume of the buildings, the total energy used, its related bill already paid, the index of energy consumption, and also the potential saving being compared to standard.

```
Calculation of Building Area and Volume
-----
| Floor # | L (m) | W (m) | H (m) | A (m2) | Vol (m3) |
-----
| 1 | 16.00 | 10.00 | 10.00 | 160.00 | 960.00 |
-----
| Total | 160.00 m2 | 960.00 m3 |
-----

ECI and IRPE of Building
-----
Total kWh of Building : 143380.00 (kwh)
Total Rp of bill of Building : 1317739.00 (Rp)
Total Building Area : 160.00 (m2)
ECI of building : 895.63 (kWh/m2)
IRPE of building : 8235.87 (Rp/m2)
Standard of Minimum ECI : 165.00 (kWh/m2/th)
Standard of Maximum ECI : 295.00 (kWh/m2/th)
Saving ECI Minimum : 730.63 (kWh/m2/th)
Saving ECI Maximum : 600.63 (kWh/m2/th)

Start Milliseconds: 789
End Milliseconds: 964
Milliseconds Execution Time: 175
```

Fig. 7. Results of program running for Case 4

The execution times of both Case 1 and Case 4 are very different, as the amount of data to be processed in Case 1 is higher than that in Case 4, as can be seen from Table I. There are three kWh-meters at the building 1, but only one kWh-meter at the building 4.



Table 1. Results of execution time testing (in ms)

Running no.	Case 1	Case 2	Case 3	Case 4
1	210	120	150	140
2	250	140	110	150
3	270	180	140	130
4	220	160	110	130
5	230	150	150	140
6	280	150	150	120
7	290	140	160	150
8	300	140	140	150
9	240	90	120	110
10	280	90	140	110
Average	257	136	137	133

The comparison of execution times of all cases of trial is presented in Table I. It can be seen from Table I that the average value of execution time of the whole running trials is 165.75 milliseconds or 0.166 second. It is a very fast running execution time, not even one-fifth of a minute. The average value of execution time for Case 1 is far higher than those of the three other cases. It is reasonable as the amount of data to process in Case 1 is higher than those of the other three cases (Table II).

The audit software helps in simplifying and reducing the time and cost of energy audit. The results of the study will generally useful to facilitate the analysis of the energy audit, because the resulting practical software covers most measures and analyzes to be performed in an energy audit. Moreover, it gives also an understanding on how energy is used in buildings as well as on how to identify opportunities to reduce energy consumption.

Table 2. Data comparison of Case 1 and Case 4

Case	Case 1	Case 4
Amount of floors, meters	2 3	1 1
Building dimension at each floor, L, W, H	15.00 10.00 4.00 12.00 10.00 4.50	16.00 10.00 6.00
ID Meter, Power capacity (VA), Amount of monthly bill	1469096157 105000.00 12 1469096337 105000.00 12 1469096346 105000.00 12	2039539034 1300.00 12

## CONCLUSIONS AND PERSPECTIVES

From the design and development of building energy audit software described in this article, some conclusions can be drawn as follows.

- Processing energy audit data is far easier and faster with the help of a computing tool.
- A computing tool in a form of an energy audit software can be designed and built based on the parameters to determine and the corresponding required audit data.

- Recommendations to improve the energy efficiency can be proposed to the energy manager/decision maker based on the implementation results of the software on the available energy audit data.

The design and development of the audit software can also be used to identify potential priorities of measures for energy conservation and savings opportunities, either from the maintenance and operation at a low cost or even no cost at all.

Especially for the industrial/business and trade sectors, in addition to comply with government regulations related to the obligation to conduct an energy audit, it would also be beneficial to reduce the energy cost, which will furthermore reduce the operation and production cost, which can result in an increased profit margins to be gained or product competitiveness in the market.

## References

- IEEE Standard 739-1995 - IEEE Recommended Practice for Energy Management in Industrial and Commercial Facilities.
- Loganthurai, P., Subbulakshmi, S., and Rajasekaran, Vinod, 2012, "A new proposal to implement energy management technique in industries", International Conference on Computing, Electronics and Electrical Technologies (ICCEET), Tamil Nadu, India, pp. 495 – 500.
- Maricar, Noor M. and Jamal, Md Noah, 2005, "Industrial Energy Audit using Data Mining Model Web Application", TENCON 2005 IEEE Region 10, Melbourne, Australia, pp. 1 – 6.
- Melki, Sylvie and Hayek, Michel, 2009, "Building simulation tools and their role in improving existing building designs", International Conference on Advances in Computational Tools for Engineering Applications. ACTEA '09, Beirut, Lebanon, pp. 503 – 507.
- Merwe, J. S. van der and Vermeulen, H. J., 2011, "Development of an Online Energy Auditing Software Application with Remote SQL-Database Support", 46th International Universities Power Engineering Conference (UPEC), Iserlohn, Germany, pp. 1-6.
- Omar, A., Mariun, Norman Bin, Radzi, Amran Amran Mohd, 2003, "Software development for energy auditing practice", Student Conference on Research and Development (SCORED), pp. 420 – 423.
- Palanichamy, C., Nadarajan, C.; Naveen, P., Babu, N.S., and Dhanalakshmi, 1997, "Budget Constrained Energy Conservation-An

- Experience with a Textile Industry”, IEEE Power Eng Rev 17(1):58-58.
- Peraturan Pemerintah Republik Indonesia No. 70 Tahun 2009 tentang Konservasi Energi.
- Prudenzi, Alberto, Di Lillo, M., Falvo, M. C., and Silvestri, A, 2008, “A software tool for energy audit activities in buildings”, International Symposium on Power Electronics, Electrical Drives, Automation and Motion (SPEEDAM), Ischia, Italy, pp. 452 – 456.
- Thumann, Albert and Younger, William J., 2007, Handbook of Energy Audits, Lilburn, GA, Fairmont Press, Inc.
- Tim Rekayasa Sistem Tenaga, Manajemen dan Konservasi Energi, 2010, Operasional Gugus Tugas Pelaksanaan Penghematan Energi dan Air di Kantor Pemerintahan Kabupaten Pamekasan, Laporan, Fakultas Teknik UB.
- \_\_\_\_\_, 2011, Kajian Perumusan Kebijakan Efisiensi Penggunaan Energi dan Listrik di Kantor Pemerintahan Provinsi Jawa Timur, Laporan, Fakultas Teknik-PIBLAM UB.
- Ung, Guan Wah, Lee, Peng Hin, Koh, Liang Mong, and Choo, Fook Hoong, 2010, “A flexible data acquisition system for energy information”, International Power & Energy Conference (IPEC), Singapore, pp. 853 – 857.
- Van Rensburg, JFF., Mathews, EHH., Pelzer, R., 2012, “Energy management audit and recommendations at a tertiary institution”, The 9th Industrial and Commercial Use of Energy Conference (ICUE), Cape Town, South Africa, pp. 1 – 6.

## DEVELOPMENT OF LIBRARY CODES FOR PROGRAMMING THE HUMANOID ROBOTBASED ON CM-510 MODULE

Muchlas<sup>1)</sup> and Ferry Yusmianto<sup>2)</sup>

<sup>1,2)</sup>Department of Electrical Engineering, Universitas Ahmad Dahlan

E-mail: muchlas.te@uad.ac.id<sup>1)</sup>, ferry\_altispjs@ee.uad.ac.id<sup>2)</sup>

Corresponding author: muchlas.te@uad.ac.id (Muchlas)

### Abstract

*Since twenty years ago, when the Indonesia robot contest firstly was held, the techniques and methods of mapping cruising as a aspect of the mobile robot ability undergone more progress. In the contest, the robot teams of Universitas Ahmad Dahlan (UAD) has been using the humanoid robot type or the boloid robot type. The robot programmed by the original software i.e. roboplus. This roboplus program had limitations, particularly in the task programs, because the functions and values was given by the manufacturer so that the programmers in difficult circumstances. This research will develop the library codes for programming the humanoid robots based on the CM-510 module. The library codes developed uses the programming language of Atmel Studio 6 based on C language that can ease for programmer.*

*The methods used in this research are the design, implementation and testing. Firstly, the designing was done by exploring the functions that provided by the task roboplus. Exploration results used to develop the algorithm and flowchart of the developed library codes. Furthermore, the algorithm implemented by the programming using Atmel Studio 6 software. Testing was done by comparing the results of running the library codes to the default roboplus programs.*

*The research done has produced five library codes for access: (1) LED (light emitting diode) on the CM-510 module, (2) ADC ports; (3) accelerometer sensor, (4) gyroscope sensor, and (5) LM-35 sensor. Functions produced from this research are two i.e.: (1) to make the robot motion, and (2) to access the switch on the CM-510 module. The developed library codes and functions are simpler and make programmers feel easier.*

**Keywords:** library code, programming, humanoid robot, CM-510 module

### INTRODUCTION

Since twenty years ago, when the Indonesia robot contest firstly was held, the techniques and methods of mapping cruising as a aspect of the

mobile robot ability undergone more progress. In the contest, the robot teams of Universitas Ahmad Dahlan (UAD) has been using the humanoid robot type or the boloid robot type. The robot programmed by the original software i.e. roboplus. This roboplus program had limitations, particularly in the task programs, because the functions and values was given by the manufacturer so that the programmers in difficult circumstances. This research will develop the library codes for programming the humanoid robots based on the CM-510 module. The library codes developed uses the programming language of Atmel Studio 6 based on C language that can ease for programmers.

Through this research, also will proven that the developed library codes can be used to access the additional sensors such as temperature sensor LM 35. By using the sensor, the humanoid robot can be applied as a fire extinguisher robot in legged division and programming can be done easily.

Development of programming to access the accelerometer sensor has done before by Haryati & Kusumaningrum (2008), Riskiyanto (2011), Alma'i, et al. and Chrismawan (2012). Meanwhile, the development of programming to access the gyroscope sensor has also done by Mubarak (2011) and Riskiyanto (2011) as well as Setyawa and Roni (2011), while the application of dynamixel by Balwell (2011). Mostly, the developments done using the manufacturer's default program. This research will develop the library codes that will make the programmer feel easier in accessing the needed sensors in the development of humanoid robot applications.

### METHOD

This section will describe briefly: humanoid robot, module CM-510 as the main controller to the robot, Dynamixel AX-12 + as robot actuators, gyroscope sensor, accelerometer sensor, LM-35 sensor, roboplus, Atmel Studio 6 GCC, and development procedures of the library codes using Atmel Studio 6 and testing it.

### The Humanoid Robot

Definition of robot can be found from dictionaries e.g. Online Merriam-Webster Dictionary. From that dictionary, the robot is defined as a machine that looks like a human being and performs various complex acts (as walking or talking) of a human being. Meanwhile, from Bioloid User's Guide, humanoid or bioloid robot is defined by Robotis (2006) as a robot kit where the user can build anything they desire, just like the Lego sets. But unlike the Lego sets, the robot is built with blocks that are actuated, so the joints can move. The name of bioloid comes from the words "bio", "all", and "oid" meaning that any living thing can be built in the form of a robot.

### The CM-510 Module

According to Robotis (2006), CM-510 is defined as a controller module that can be used to store and execute the programs in robotics and control application with the AX series Dynamixel actuators. The controller module is equipped with ports for connection to an external sensor device. Module CM-510 controller is based on ATmega2561 microcontroller from the AVR family of 8-bit RISC.



Figure 1. The CM-510 module

### The AX-12+ Dynamixel Output Module

Furthermore, dynamixel is one type of output modules that can be connected to the CM-510 controller. The module is capable to measure the position, velocity, temperature, voltage and torque. Figure below shows the dynamixel AX-12+ and its internal schematic.



Figure 2 (a). The Dynamixel AX-12+ module

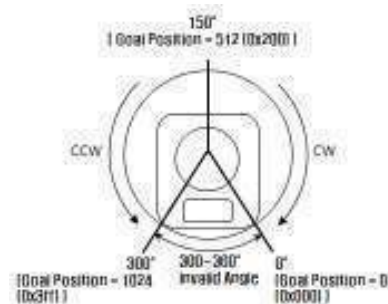


Figure 2 (b). Internal Schematic of AX-12+

### The GS-12 Gyroscope Sensor

The Gyroscope sensor is a transducer that is used to measure the acceleration and vibration. This sensor can read the dynamic angular velocity (angular rate). After computing using the integral of data from time to time, the displacement of angle or tilt angle can be calculated. This sensor responsible for maintaining the stability of the robot body so that when the robot perform in difficult movements, still standing upright. Gyroscope sensor specification GS-12, i.e.: (1) range of the angular velocity measurement  $-300^\circ/\text{sec}$  up to  $+300^\circ/\text{sec}$ , (2) operating temperature:  $-40^\circ\text{C}$  up to  $+85^\circ\text{C}$ , (3) voltage of 4.5 V to 5.5 V.

### The MMA7361 Accelerometer Sensor

The accelerometer sensor used in this study is MMA7361 with three-axis, namely X, Y and Z axis. This sensor used on a robot to measure the tilt angle (tilt) when the robot is in static condition. In this case, the robot does not move but just the angle changes, such as the robot falls forward or backward. When the system is rotating or moving, accelerometer sensor can not follow the rapid movement due to slow response and has noise. Readings by the accelerometer sensor on the robot is done by changing the acceleration motion on the robot into a voltage.

### Temperature LM-35 Sensor

LM-35 is a sensor that can measure the temperature. This sensor will change the temperature into a voltage. The sensor works with a voltage of 5 V and from the datasheet, the sensor can read the temperature with sensitivity of  $10\text{mV}/^\circ\text{C}$ .

### Roboplus Software

Roboplus Software is a combination of three software i.e. roboplus manager, roboplus motion and task roboplus. Each has a different function. Roboplus manager serves to regulate roboplus devices that connected to the CM-510 or CM-700.

Motion is one of the facilities provided by roboplus, and this program used to design the motion system of the humanoid robot. In this program, there are facilities of page, step, basic poses editor, and poses utility. Roboplus task is one of the facilities provided by roboplus that serves to create and design a program that is used to call the program motion.

#### Atmel Studio 6

Atmel Studio 6 GCC is a C compiler that provided by AVR Studio. AVR Studio is an application by Atmel for making ease in the microcontroller programming. This application is quite complete because it has been equipped with a downloader and simulators. Atmel Studio 6 GCC is a free software, so there are many libraries provided on the Internet.

#### Development of Library Code in Atmel Studio 6

The first stage in the development of the library code are exploring and trying the original program of task roboplus using the PC. The next step is understanding the functions provided by the task roboplus. The next process is making the program flowchart. This flowchart will be used to help researcher making the program library, i.e. the programming and the new library according to the algorithm of the Task Roboplus using Atmel Studio 6 software.

The library name begins with lib word and \*. a extension. Making library file begins with selecting the programming type provided by Atmel Studio 6, i.e. the GCC Static Library. Furthermore, choosing the microcontroller to be used in the library. The next step is save the settings that have been done with the extension \*. a. The next process is write a program or code that is used to fill the microcontroller on the editor sheet. These files are then processed into object files, and object files packaged into a library file (\*. a).

#### Testing

Testing was done by running the roboplus original programs and the developed library programs.

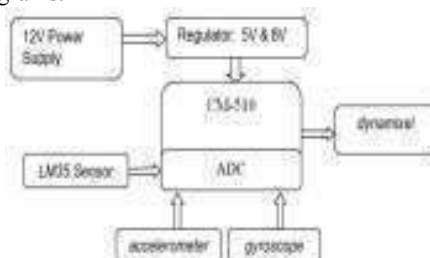


Figure 3. Hardware for testing

Results of running these two programs were compared in terms of performance and the ease of writing programs. Testing requires hardware support as shown in the figure 3.

## RESULT AND DISCUSSION

### Input-Output Function Testing

Input-output function testing was done by programming to control all the LED and the button on the CM-510. The results show that the task roboplus program can just access AUX LED, meanwhile the developed library program can access all the LEDs in the CM-510 module.

The next step is testing for controlling the button on the CM-510 module using the developed library program. According to the test, the program can be used to access all the buttons on the CM-510 module. The tests have shown that the library program can effectively to control all the LEDs on the CM-510 module and also shown that the programmers can make programs easier because it is available in the library programs.

### LM-35 sensor testing

The LM-35 testing sensors using library program has result the data as presented in the figure below.

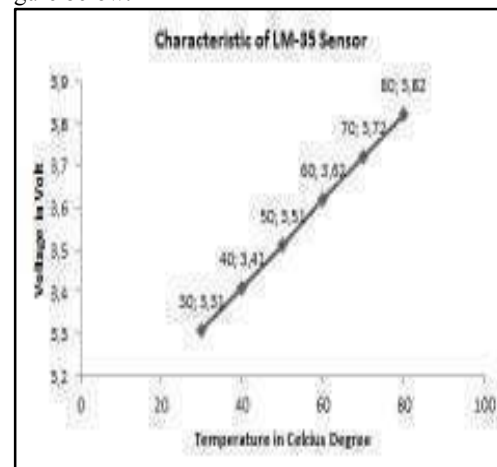


Figure 4. Characteristic of LM-35 sensor

The figure above shows that the relationship between voltage (V) and temperature (°C) that resulted from LM-35 testing is linear. This characteristic is similar to the information provided by the manufacturer through the datasheet. This mean that the LM-35 can convert the temperature to voltage effectively when programmed using the developed library program. So, the developed library can be used to control the temperature sensor LM-35 effectively.

### Testing of Gyroscope Sensor

The results of test using the task roboplus programs and library programs for the X-axis gyroscope shown in the figure below.

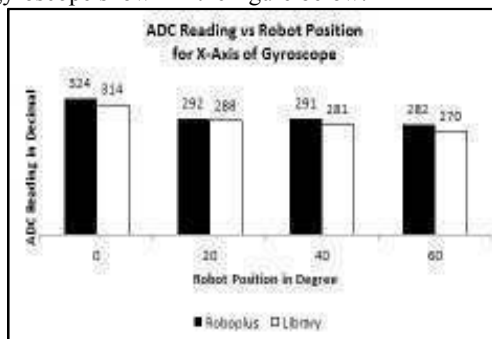


Figure 5. ADC reading for X-axis of gyroscope

As for the Y axis of the gyroscope, test results are shown in the following figure.

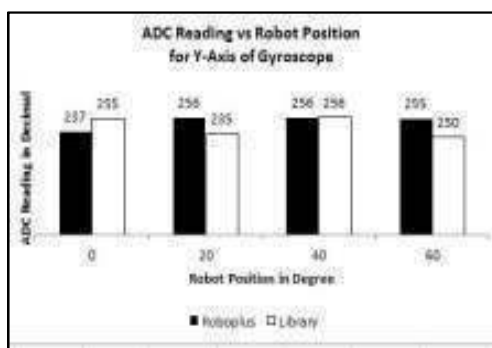


Figure 6. ADC reading for Y-axis of gyroscope

Based on the pictures above, the ADC readings for each robot position showed relatively similar results between roboplus programs and library programs for the X axis and Y axis. So that the developed library program can be used to access the gyroscope sensor and can control it accurately.

### Testing of Accelerometer Sensor

Accelerometer testing was conducted under stationary condition of sensors. Thus, this test aims to test the sensors for measuring the acceleration of gravity. The test was conducted using the task program of roboplus and the developed library program. Test results for the X, Y, and Z-axis of the accelerometer sensors, is shown in the following table.

Table 1. ADC Reading for each axis of accelerometer

$\theta(^{\circ})$	ADC Reading for X-Axis		ADC Reading for Y-Axis		ADC Reading for Z-Axis	
	Roboplus	Library	Roboplus	Library	Roboplus	Library
0	321	320	188	190	285	283
45	322	325	243	246	397	398
90	324	326	351	357	437	439
180	330	331	506	506	239	238

The table above shown that the ADC readings for all axis accelerometer has a value that is relatively similar between roboplus with library programs. This shows that the developed library program can be used to access the accelerometer and provide accurate and effective performance. The advantages of the library program is able to display the value that containing decimal numbers and is easy to write the programs.

### Testing of Dynamixel AX-12 + Sensor

The test results of program to drive the Dynamixel servo shown in table below.

Table 2. Data of AX-12 testing

Number of Test	Goal Position	Degree ( $^{\circ}$ ) of Servo	
		Roboplus	Library
1	0	0	0
2	512	150	150
3	1024	300	300

Goal position is the value sent to the servo for performing the movement. The value for the Dynamixel servo AX-12 + is from 0 to 1024. When the value sent is 1024, servo will move towards the maximum angle i.e. 300 degree. According to the table above, by using the roboplus program or the library program, the servo can move matching to the characteristics of servo Dynamixel AX-12 +. In addition, compared to roboplus, the developed library programs can be used to turn the servo over 7 steps.

### CONCLUSION

The research done has shown that the developed library programs can be used to access: (1) LED (light emitting diode) on the CM-510 module, (2) ADC ports; (3) accelerometer sensor, (4) gyroscope sensor, and (5) LM-35 sensor. This research also produced the functions that can be used to make the robot motion, and to access the switch on the CM-510 module. The developed library codes and functions are simpler and make programmers feel easier.

## References

- Alma'i, V. R., Wahyudi, & Setiawan, I. *Application of Accelerometer Sensor for Position Detection*: Faculty of Engineering, Universitas Diponegoro.
- Balwell, N. S. (2011). *Designing of 2 DoF Bilateral Teleoperation System Using Dynamixel AX-12+ With Torque Parameter Control for Increasing the Haptic Sense*. Thesis S1, Unpublished, Faculty of Engineering, Universitas Indonesia.
- Chriskawan, Y. A. (2012). *Portable BrakesTest Device for Wheels 4 Vehicle Using Accelerometer Sensor and Force Sensor Based on Microcontroller*. Thesis S1, Unpublished, Faculty of Engineering, Universitas Kristen Satya Wacana.
- Haryati, M., & Kusumaningrum, N. (2008). *Application of 3-Axis Accelerometer for Mesasuring the Tilt of the Satellite Model on Air Bearing*. *TESLA*. 10 (2): 1-2
- Mubarok.(2011). *Rotation Detector Using Gyroscope Sensor Based on ATmega8535 Microcontroller*. Thesis S1, Unpublished, Universitas Diponegoro.
- Riskiyanto.(2011). *Designing of Stabilization System for the Humanoid Robot Using Accelerometer and Gyroscope Sensor*. Thesis S1, Unpublished, Faculty of Engineering, Universitas Ahmad Dahlan.
- Robotis. (2006). *Bioid User's Guide*. Seoul: Robotis, Inc.
- Setiawan, Roni. (2011). *Designing of Soccer Humanoid Robot Using a Motion Programming*. Thesis S1, Unpublished, Faculty of Engineering, Universitas Negeri Yogyakarta.

## ANALYSIS OF MINIHYDRO POWER AND PHOTOVOLTAIC INJECTION INTO THE GRID SYSTEM

**Hadi Suyono, Muhammad Fauzan E.P., Hari Santoso**

Department of Electrical Engineering, Faculty of Engineering, Brawijaya University  
Jl. MT. Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Email: hadis@ub.ac.id, mfauzanep@ub.ac.id, hari.santoso53@yahoo.com

### **Abstract**

*The supplying of the energy power needs the reliability and continuity of services that meet both technical and economic requirements. The availability of the power sources need to be extended and expand to discover alternative sources such that have little impact on the environment but have masive amount. Photovoltaic (PV) as a source of solar energy has not been widely used in Indonesia, while micro/ mini hydro power has been widely implemented in the distribution system. Therefore, the effect of injection of minihydro of power plants and PV power plant to the grid system is analyzed in this paper so that the system power losses and voltage are in accordance with the nasional standard (SPLN) and internasional standard (IEEE). In this paper, Turen substation is one of substation in Malang Area-Indonesia, which serves 10 feeders with the total load of 24.9MVA will be as a study case. The system also conected to the 2x5.5MVA minihydro of Ampelgading. However based on the water availability, the power produces by the minihydro would be divided into 3 conditions: all units off, 1x5.5MVA unit on, and 2x5.5MVA unit on. On the other hand, the availability of the solar energy of 0.5MVA could be implemented in the system so that the system profiles would be improved. For the cases in which the system is only supplied by the grid system and minihydro power of Ampelgading, voltage profiles 20kV decrease to below 0.95pu for most busses. This is due to Turen Substation and minihydro Power of Ampelgading was injected through a double circuit with a relatively far distance of 33 kMs. This situation will cause a voltage drop and power loss will be high. The increasing of power transfer will impact to the increasing of the voltage drop and power loss. Voltage profile will be improved by the penetration of 0.5MVA of PV system, the overall profile of the voltage above 0.95pu. The power losses also will be decrease with the injection of the PV system about 1.66%.*

**Keywords:** Minihydro power, photovoltaic, voltage profile, power losses, steady state analysis

### **INTRODUCTION**

One of the alternative energy sources of renewable energy is a hydroelectric power station (mini/micro- hydro) which is developed and extended extensively in Indonesia. The plants can be interconnected with the distribution system, thus it can be a dispersed small-scale electrical power generation plants.

The addition of alternative power sources is not only to generate electricity but is also expected to have small impact on the environment. The alternative is the development of new and renewable energy including solar power plants, hydroelectric plants (mini/micro hydro), wind power, biomass, and other sources.

The generating units of the renewable energy system developed now includes a small-scale in terms of power output but have massive amount. The small generating unit power plants which are typically interconnected or injected to the distribution system are often called as Dispersed or Embedded Generations. The renewable energy that has been widely developed is solar power (photovoltaic) and mini-scale hydropower. The power plants that are interconnected to the distribution system, so it can be a dispersed small-scale electrical power generation plants or dispersed generation [1].

For the purposes of operating the electric power system, especially in the grid system distribution systems, electric company has set the standard that must be met with regard to planning and operation that is based on international and national standards. For the national standard used is Standard Electricity Company (SPLN) and the Indonesian National Standard (SNI), while the international standard is the standard for the Institute of Electrical and Electronics Engineers (IEEE) and the International Electrotechnical Commission standard (IEC). Parameters of voltage,



frequency and maximum load are important parameters in the distribution system. The standard voltage would be of  $\pm 5\%$  of nominal voltage, while the standard frequency is  $\pm 2.5\%$  of the natural frequency [2].

Minihydro and PV generating units are voltage sources that are injected into the distribution system will supply the active and reactive powers in accordance to the capabilities and power load requirement. With the inclusion of Minihydro and PV will affect the existing distribution system in terms of: a) the change in the voltage profile [3], b) an increase in the fault level of network c) power quality in this case the variation of transient voltage and harmonic distortion [4]; d) protection system, and e) the stability of the system.

In this paper, Turen substation is one of substation in Malang Area-Indonesia, which serves 10 feeders with the total load of 24.9MVA will be as a study case. The system also connected to the 2x5.5MVA minihydro of Ampelgading. However based on the water availability, the power produce by the minihydro would be divided into 3 conditions: all units off, 1x5.5 MVA unit on, and 2x5.5MVA unit on. On the other hand, the availability of the solar energy of 0.5MVA could be implemented in the system so that the system profiles would be improved.

### DISTRIBUTED GENERATION (DG)

The injection of DG in the distributif system will influence on the power transfer, voltage profil, power losses, and stabilityof electric power systems. In term of stability, the rotor angle deviationbetweenthe generators will be decreased with the increasing of DG penetration levels. The frequency response is also faster with maximum frequency deviation higher, with increasing of the DG injection [5]. DG placement location also affects the reliability and efficiency of power with load variations and reduces power losses [6]. DG stability during fault conditions using tuning PID control based on the Ziegler-Nichols method, by performing simulations on the IEEE standard for 13 points of distribution feeder, said that, load variations and disturbances will affect the stability response of the DG [7].

### STEADY STATE ANALYSIS

Electric power system is a system that carries electricity network. Therefore, Beach nodes/buseswill have an active power (P), reactive power (Q) and the voltage (E). Usually the voltage expressed in the magnitude and the phase angle( $\delta$ ).

Thus for eachbus, there are four main parameter i.e. P, Q, E and $\delta$ . In thepowerflow studies, twoofthe fourmagnitudeare known,andthe other twoneed to besought. Basedon the foregoing, the busescan be divided intothreetypes, namely the busload, generatorbus, andthe swing bus(slack bus). Equationsof powersystem performancacan be expressedin the form ofbusimpedance( $Z_{bus}$ ) orbusadmittance( $Y_{bus}$ ) as follows:

$$E_{bus} = Z_{bus} I_{bus} \quad (1)$$

$$I_{bus} = Y_{bus} E_{bus} \quad (2)$$

The admittance and impedannce matrices can be created with or without involving ground bus. If the grounf bus is not involved in preparing the  $Z_{bus}$  or  $Y_{bus}$  matrices, it is necessary to choose a certain bus as a reference such that all the voltage vector  $E_{bus}$  are refered to the bus reference. At a bus  $p$ , active and reactive power is expressed as:

$$P_p - jQ_p = E_p^* I_p \quad (3)$$

Where:

$P_p$  : Active power at bus  $p$  (MW)

$Q_p$  : Reactive power at bus  $p$  (MVAR)

$E_p$  : Voltage include the phase angle (V)

$I_p$  : injected current at  $p$  (A)

The current flow at bus would be:

$$I_p = \frac{P_p - jQ_p}{E_p^*} \quad (4)$$

$I_p$  has positive polarity if the current flowing into the system. If the shuntelements of the land involved in preparing or  $Z_{bus}$  or  $Y_{bus}$  matrices, then equation (4) represents the total current flowing from bus  $p$ , otherwise the total current flowing through the bus  $p$  is:

$$I_p = \frac{P_p - jQ_p}{E_p^*} - y_p E_p \quad (5)$$

Where  $y_p$  denotes the total busshunt admittance krom bus  $p$  to ground and  $y_p E_p$  is the current flowing from the  $p$  to the ground bus. To determine the voltages for each bus, the Newthon Raphson method as an iterative methode is performed. After the iteration process to determine thevoltage of each bus is completed, the power flow on each line can be calculated. The current flowingfrombus $p$  tobus $q$ can be calculated by using:

$$i_{pq} = (E_p - E_q) y_{pq} + E_p \frac{y'_{pq}}{2} \quad (6)$$

where:

$i_{pq}$ : current flow from bus  $p$  to bus  $q$  (A)

$y_{pq}$ : Branch admittance connected between bus p and bus q (mho)

$y'_{pq}$ : half line charging in bus  $p$  and bus  $q$  (mho)

The active power ( $P_{pq}$ ) and reactive power ( $Q_{pq}$ ) flows from bus  $p$  and bus  $q$  is:

$$P_{pq} - jQ_{pq} = E_p^* i_{pq} \quad (7)$$

$$P_{pq} - jQ_{pq} = E_p^* (E_p - E_q) y_{pq} + E_p^* E_q \frac{y'_{pq}}{2} \quad (8)$$

Whereas the power flows from bus  $q$  and bus  $p$  is:

$$P_{qp} - jQ_{qp} = E_q^* (E_q - E_p) y_{pq} + E_q^* E_p \frac{y'_{pq}}{2} \quad (9)$$

where:  $P_{qp}$ : active power from bus  $q$  to bus  $p$  (MW)

$Q_{qp}$ : reactive power from bus  $q$  to bus  $p$  (MVAR)

$E_q$ : The vector voltage at bus  $q$ .

## METHODOLOGY

### Data Collection and Modelling

For the purposes of modeling and analysis the following data are required:

- Malang-Indonesia rain fall data and river debit to determine the power produced by minihydro power of Ampelgading.
- The intensity of solar irradiation in Malang.
- Data network systems including steady State and dynamic such as: single line diagram system, generator, transformer, line and load, voltage systems, power systems, and system impedance.
- Minihydro power of Ampelgading data: steady-state and short-circuit data.

Minihydro power unit is modelled as synchronous machines while the PV plant is modelled by several models of diodes. The proposed model is the most accurate and widely used model is the double-diode models that are represented as an equivalent circuit with two diodes [8]. This model is quite complex because it required the double exponential parameters and 6 parameters are necessary. Another model is the single-diode circuit model as proposed by Liu and Dougal [9] and Walker [10].

### The Proposed Simulation

After modeling of the power system including the injection of the Minihydro of Ampelgading and PV unit into the Turen Substation, to determine the voltage profile and power losses on the system, the following scenarios are proposed:

#### 1) The Supply Power: Minihydro and Grid

- The load system only acquire from the grid system, all units of minihydro off, also PV unit off,
- 1x5.5MVA unit of Ampelgading minihydro on, and PV unit off
- 2x5.5MVA unit on of Ampelgading minihydro on, and PV unit off

#### 2) The Supply Power: Grid, Minihydro, and PV

- The additional source, PV system of 0.5MVA is implemented in the system beside of grid power and minihydro power.

Furthermore, the simulation results then analyzed that includes the following analysis of the voltage profile and power losses before and after injection of embedded generation minihydro power and PV generation.

## RESULTS AND DISCUSSIONS

Single line diagram of power system Turen substation can be seen in Fig. 1 with the injection of Ampelgading minihydro power. Mean while, to determine the effect of PV injection, 20 kV distribution Bakalan feeder system is modelled in detail. Number of sub station transformer of Bakalan feeder system 20kV/380V for a total of 37 transformer which represented the number of buses needed. For PV plants injection location specified in the middle of the network that is on the bus 26. Summary of the power system model are as follows: No of buses: 55, on of lines: 53, on of transformers: 3, Number of generators: 3, and number of loads: 42. The load was 21.636 MW and 13.424 MVAR.

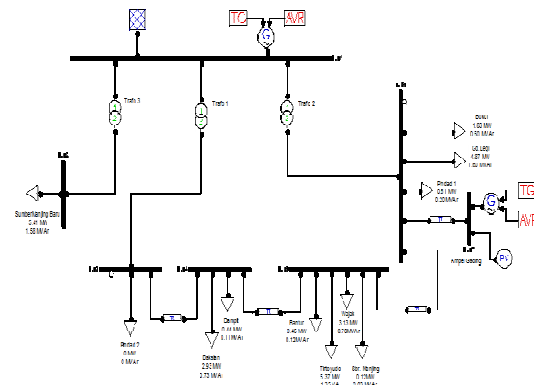


Fig. 1. Single Line Diagram of the System Test

The simulation results of the power flow for the Bakalan feeder, Turen substation with 4 (four) different scenario as given above are given in Table I, II, III and Table IV.

Tabel I  
The Voltage Profile Supplied From The Grid Only

Bus	V [p.u.]	phase [deg]	P gen [p.u.]	Q gen [p.u.]	P load [p.u.]	Q load [p.u.]
Bus1	1.000	0.000	0.218	0.155	0	0
Bus2	0.979	-1.723	0	0	0.046	0.028
Bus3	0.949	-4.025	0	0	0	0
Bus4	0.949	-4.013	0	0	0.004	0.002
Bus5	0.948	-4.006	0	0	0.077	0.047
Bus6	0.948	-4.007	0	0	0.061	0.038
Bus7	0.948	-4.007	0	0	0	0
Bus14	0.944	-4.155	0	0	0.001	0.000
Bus15	0.941	-4.224	0	0	0.001	0.000
Bus21	0.928	-4.601	0	0	0	0
Bus26	0.919	-4.854	0	0	0	0
Bus36	0.909	-5.156	0	0	0	0
Bus40	0.908	-5.202	0	0	0	0
Bus41	0.908	-5.204	0	0	0.001	0.000

Tabel II  
The Voltage Profile Supplied From The Grid AND  
2x5.5MVA Minihydro

Bus	V [p.u.]	phase [deg]	P gen [p.u.]	Q gen [p.u.]	P load [p.u.]	Q load [p.u.]
Bus1	1.000	0.000	0.141	0.165	0	0
Bus2	0.979	-0.030	0	0	0.046	0.028
Bus3	0.945	-0.038	0	0	0	0
Bus4	0.945	-0.038	0	0	0.004	0.002
Bus5	0.944	-0.037	0	0	0.077	0.047
Bus6	0.945	-0.037	0	0	0.061	0.038
Bus7	1.000	0.092	-0.083	0.008	0	0
Bus14	0.939	-0.040	0	0	0.001	0.000
Bus15	0.937	-0.041	0	0	0.001	0.000
Bus21	0.924	-0.048	0	0	0	0
Bus26	0.915	-0.052	0	0	0	0
Bus36	0.905	-0.058	0	0	0	0
Bus40	0.903	-0.059	0	0	0	0
Bus41	0.903	-0.059	0	0	0.001	0.000

Of the four cases the steady-state analysis is done through the analysis of load flow studies to obtain the voltage profile and power losses in the system. For the case 1-3 where the power system is supplied from the grid and minihydro power, voltage profiles 20kV decrease to below 0.95pu for most busses. This is due to Turen Substation and minihydro Power of Ampelgading was injected through a double circuit with a relatively far distance of 33 kMs. This situation will cause a voltage drop and power loss will be high. The increasing of power transfer will impact to the increasing of the voltage drop and power loss. Voltage profile will be improved by the penetration of PV 0.5MVA as given in Table IV, the overall profile of the voltage above 0.95pu.

Tabel III  
The Voltage Profile Supplied From The Grid AND  
1x5.5MVA Minihydro

Bus	V [p.u.]	phase [deg]	P gen [p.u.]	Q gen [p.u.]	P load [p.u.]	Q load [p.u.]
Bus1	1.000	0.000	0.178	0.144	0	0
Bus2	0.979	-0.030	0	0	0.046	0.028
Bus3	0.953	-0.053	0	0	0	0
Bus4	0.953	-0.053	0	0	0.004	0.002
Bus5	0.953	-0.053	0	0	0.077	0.047
Bus6	0.953	-0.053	0	0	0.061	0.038
Bus7	1.000	0.000	0.041	0.008	0	0
Bus14	0.948	-0.056	0	0	0.001	0.000
Bus15	0.946	-0.057	0	0	0.001	0.000
Bus21	0.933	-0.063	0	0	0	0
Bus26	0.924	-0.068	0	0	0	0
Bus36	0.914	-0.073	0	0	0	0
Bus40	0.912	-0.074	0	0	0	0
Bus41	0.912	-0.074	0	0	0.001	0.000

Tabel IV  
The Voltage Profile Supplied From The Grid,  
1x5.5MVA Minihydro And 0.5MVA OF PV

Bus	V [p.u.]	phase [deg]	P gen [p.u.]	Q gen [p.u.]	P load [p.u.]	Q load [p.u.]
Bus1	1.000	0.000	0.174	0.095	0	0
Bus2	0.979	-0.030	0	0	0.046	0.028
Bus3	0.973	-0.052	0	0	0	0
Bus4	0.973	-0.052	0	0	0.004	0.002
Bus5	0.972	-0.051	0	0	0.077	0.047
Bus6	0.973	-0.051	0	0	0.061	0.038
Bus7	1.000	0.013	-0.041	0.005	0	0
Bus14	0.976	-0.058	0	0	0.001	0.000
Bus15	0.977	-0.062	0	0	0.001	0.000
Bus21	0.988	-0.081	0	0	0	0
Bus26	1.000	-0.095	0.005	0.059	0	0
Bus36	0.991	-0.100	0	0	0	0
Bus40	0.989	-0.101	0	0	0	0
Bus41	0.989	-0.101	0	0	0.001	0.000

Tabel V  
The Summary of Power Losses With Different  
Cases

Case	Generation P (MW)	Load Q (MVAR)	Losses P (MW)	Generation Q (MVAR)	Load P (MW)	Losses Q (MVAR)
1	21.810	15.543	21.636	13.424	0.174	2.119
2	22.386	15.780	21.636	13.424	0.750	2.357
3	21.935	15.188	21.636	13.424	0.299	1.765
4	21.991	14.919	21.636	13.424	0.355	1.496

The analysis of power losses is given in Table V. Scenario 2 with injection minihydro (2x4.125 MW) without generating PV (0 MW), giving the highest power loss of about 3.35% and 14.93% for active to reactive power with respect do the totalgeneration. With the injection of PV for 4 cases, the power losses would be decreased by an average power loss are about 1.66% and 10.2% for active and reactive powers with respect to the total of generation.

## CONCLUSION

Based on the availability of water for the operation of micro power Ampel Gading and the possibility of the availability of solar irradiation, the analysis has been divided into four cases, namely: 1) minihydro (0 MW), PV (0 MW), 2) minihydro (2x 4,125 MW), PV (0 MW); 3) minihydro (1x4.125 MW), PV (0 MW), 4) minihydro (1x4.125 MW), PV (0.5 MW).

For the case 1-3 where the power system is supplied from the grid and minihydro power of Ampelgading, voltage profiles decrease to below 0.95pu for most busses. This is due to Turen Substation and minihydro Power of Ampelgading was injected through a double circuit with a relatively far distance of 33 kMs. Voltage profiles have been improved by the penetration of 0.5MVA, the overall profile of the voltage above 0.95pu. Injection of minihydro power and PV plants have provided the improvement of the voltage profile and reduction of power losses in the grid system.

## References

- [1] Jinkens N., Allan R, Cossley P., Kirschen D., and Strbac G., Embedded Generation, The Institution of Electrical Engineers, London, 2000
- [2] ANSI/IEEE Std 446-1995, IEEE Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications, pp:1-272
- [3] Woyte A., Vu Van T., Belmans R., Nijs J., 2006, Voltage fluctuations on distribution level introduced by photovoltaic systems, IEEE Transactions on energy conversion, Vol.21, Issue 1, ISSN 0885-8969, IF 0.716, March; pp. 202-209.
- [4] Freitas, Walmir ; Vieira, José C M, Jr. ; Morelato, Andre L; Da Silva, Luiz C Pereir ; Da Costa, Vivaldo F. ; Lemos, Flhvio A Becon, 2006, "Comparative analysis between synchronous and induction machines for distributed generation applications", IEEE Transactions on Power Systems, Volume: 21, Issue: 1, pp: 301-311
- [5] Azmy, A.M.; Erlich, I.; 2005, Impact of distributed generation on the stability of electrical power system, IEEE Power Engineering Society General Meeting, Pp: 1056 – 1063, Vol. 2
- [6] Zhu, D.; Broadwater, R.P.; Kwa-Sur Tam; Seguin, R.; Asgeirsson, H.; 2006, Impact of DG Placement on Reliability and Efficiency with Time-Varying Loads, IEEE Transactions on Power Systems, Volume: 21 , Issue: 1, Page(s): 419- 427
- [7] Grigsby, Leonard L. 2007. Power System Stability and Control. New York: Taylor & Francis Group, LLC.
- [8] Gow, J.A.; Manning, C.D.: Development of a photovoltaic array model for use in power electronics simulation studies, IEE Proc. Electr. Power Appl., Vol. 146, No.2, March 1999, pp.193-200.
- [9] Liu, S.; Dougal, R.A.: Dynamic Multiphysics Model for Solar Array, IEEE Trans. on Energy Conversion, Vol. 17, No. 2, June 2002, pp. 285- 294.
- [10] Walker, G.: Evaluating MPPT Converter Topologies using a Matlab PV Model, Journal of electrical and electronics engineering, Australia, Vol. 21, pp. 49-55, 2001.

**EFFECT OF ETHANOL-96%  
IN GASOLINE WITH MIXTURE RATIO OF 1:9 AND 2:8  
ON THE COMBUSTION AND EMISSION OF 125cc FOUR-STROKE ENGINE**

**Dwi Fadila Kurniawan, Eko Siswanto, Erni Yudaningtyas and Eka Maulana**

Electrical Engineering Department, Brawijaya University

Jl. MT Haryono 167 Malang 65145, Ph./Fax: 0341-554166

Corresponding email: df\_kurniawan@ub.ac.id

**Abstract**

*This paper is purposed to describe the development of a main control unit (MCU) in an engine to support the transition in the use of fuel, from gasoline to ethanol. The study was conducted in several stages, beginning with the initial determination of the engine character engine, followed by an in-depth observation on the effect of ethanol in a gasoline mixture with proportion of 1:9 and 2:8. Furthermore an MCU was designed to optimize the combustion process of the mixture. So far, it is found that the addition of ethanol results in less perfect combustion in a standard engine while at same time decreasing the CO gas emission level, increasing HC and O<sub>2</sub> gases, whereas the CO<sub>2</sub> gas tends to remain.*

**Keywords:** MCU, ethanol, combustion, four stroke engine

**INTRODUCTION**

The increasing number of vehicles influences directly the increase in fuel consumption. This condition is continuing until one day there is no more oil reserves available. It is predicted that oil reserves would run out in about 30 years.

On the other side, the increasing number of fuel consumption has negative impacts on the environment, as it declines the air quality because of the pollution. This condition impact public health adversely, especially in large cities.

To anticipate the aggravating condition, many researchers keep trying to look for alternative energy sources which is renewable, for example those derived from plants, to substitute fuel. One of the renewable energy source is ethanol.

Many researches have been done on the use of ethanol as a substitute for fuel (Gasohol: a mixture of gasoline and ethanol). The content of ethanol used varies from some concentration value up to pure ethanol (100%), for example E15 (15% of ethanol ethanol mixed with 85% of gasoline)[1], E20[2], and E100[3]. The use of E20 to substitute

for gasoline in a vehicle without any modification of the engine resulted in the relatively same performance with a significant reduction in toxic emissions[2].

The study the results of which are presented in this paper was conducted to design and develop a simple electronic device (MCU) to control the fuel ignition system in a vehicle, when ethanol in a certain concentration is used as substitute for fuel. It is expected to contribute to the smooth transition from the dependence on oil fuel to the use of ethanol as renewable fuel derived from plants. The need for such this MCU is related to the change in fuel characteristics which requires some changes in the fuel ignition system to result in an optimum combustion condition without having to make extreme modifications on the engine. Therefore, there will be no much problem and difficulty for vehicle users, so that the transition of the fuel types use would be readily accepted by the public.

This paper presented some of the results, namely the determination of the initial conditions when the engine uses gasoline (premium), E10, and E20. It is important to present these results as the data collection process was done using a 125cc small-capacity engine commonly used by people, and using a mixture of 96% ethanol containing certain amount of water, which will more or less affect the combustion process in the engine.

**THE USE OF ETHANOL AS FUEL**

Ethanol (ethyl-alcohol) is one type of alcohol that can be used as fuel. The use of pure alcohol in a 4-stroke engines mixed with gasoline in varying ratios can be used as fuel for engine with certain modifications. Ethanol which is already widely used is the type of E10 (Gasohol). This type of ethanol can be used by new vehicle 4-stroke engine which typically use gasoline without any modification. There are still no sufficient data about the implementation of E10 on old vehicles [4]. Comparison properties E10 and E20 is shown in Table I.

The use of E10 can produce optimum performance if the ignition is -1 degree in advance

of the standard value, whereas the E20 needs -6 degrees[5].

Table I  
Characteristics of gasoline, ethanol E10, and E20

Properties	Gasoline	Ethanol	E10	E20
Heating value (kJ/kg)	44,000	27,000	41,900	40,000
Stoichiometric air/fuel ratio	14.6	9	14	13.5

Some countries have already developed cars with ability to adapt to the changes in fuel. In Brazil the Hi-Flex technology was developed and embedded in a Renault Clio engine, making it able to use pure gasoline, gasoline- ethanol mix, or pure ethanol, as fuel. This ability is obtained by applying the automatic settings to obtain optimum engine efficiency.

The Clio's power curve measurement results showed an increase of 1 horsepower throughout the revolution speed range of the engine when using ethanol with 5-8 degrees of ignition in advance of the optimal setting when using gasoline.

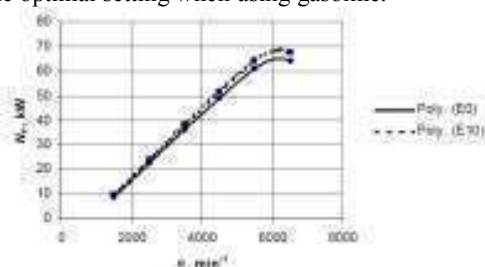


Fig. 1. Effect of ethanol blends on power [7]

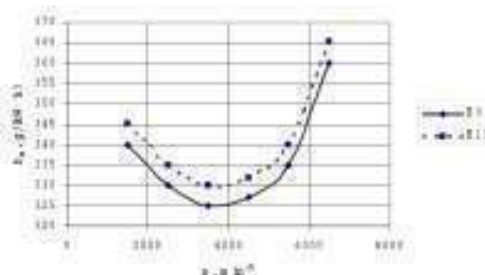


Fig.2. Effect of ethanol blends on specific fuel consumption[7]

Being compared to gasoline, ethanol has a disadvantage of Lower Heating Value (LHV), approximately 26.8 MJ/kg lower than gasoline (43.2 MJ/kg), making the engine less powerful. Another disadvantages is that its heating calorific value during vaporization is much higher (841 kJ/kg) than gasoline (360 kJ/kg), making it difficult to burn. Yet ethanol has the advantage that the amount of air required to achieve the stoichiometric condition is 9.0078 smaller than gasoline (14.6).

The other benefit is that the ethanol possesses the higher value of Research Octane Number(ROD) than gasoline. Its ROD value is 129, which is much higher than that of gasoline(95), so it can be functioning with a higher compression ratio to produce greater efficiency. AS a consequence, to improve the engine performance it is required to supply the engine with denser and more compression, which can be practically done by applying a turbocharger [2].

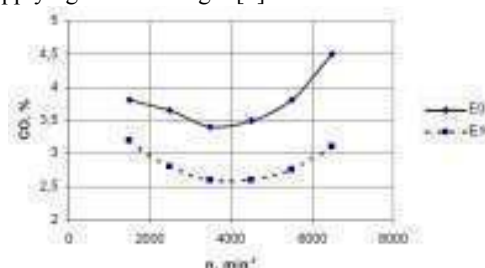


Fig.3. Effect of ethanol blends on CO emission[7]

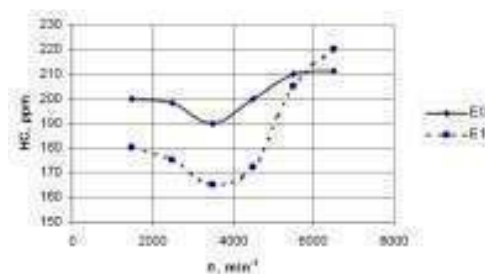


Fig.4. Effect of ethanol blends on HC emission[7]

The flame speed of ethanol is higher than that of gasoline. Ethanol has a laminar flame speed of 41-50 cm/s, whereas gasoline has a laminar speed of 33-39 cm/s, under the room condition. Flame speed increases with the compression increase in combustion chamber which reaches values greater than 10 bar and a temperature of 700 K[6]. Consequently, a proper ignition timing is required to gain optimum performance.

From some previous studies it is known that engine modifications are not required for the use of gasoline mixture up to 10% ethanol (E10). However, being compared to gasoline some

changes in performance parameters can be observed[7]:

1. Gasoline octane >95, E10>98.9
2. Rising E10 fuel consumption of 2-3%
3. Rising power engine up to 5%
4. Decreasing E10 CO emissions of 10-30%
5. Rising E10 CO<sub>2</sub> emissions of 5-10%.

Some other effects that appeared later after the addition of ethanol into gasoline are as follows:

1. Octan number became higher (RON of ethanol was 10, that of gasoline was 95), thus resulting cleaner combustion
2. The engine power became decreasing (84400Btu/galon of ethanol, 125000Btu/ galon of gasoline)
3. Engine ignition under cold condition became harder
4. Several other problems appeared, being associated with the corrosive nature of ethanol.

#### EXPERIMENTAL SETUP

Steps done during the study are begun with the determination of engine and fuel initial characteristics, which are the initial conditions when engine uses gasoline, E10, and E20. The following step is making a simulation to determine the optimum time of fuel ignition. Furthermore, an MCU is designed based on the results of engine characteristics determination and the ignition time mapping from simulation results. Finally, the designed MCU is tested to optimize the combustion process when using the E10 and E20.

The experiment was carried out at the Laboratory of Combustion Engine of Mechanical Engineering Department at Brawijaya University.

Some materials/ ingredients and equipments used are as follows:

- Material: premium gasoline with 88 octane
- Ethanol 96%

whereas, the tools used are :

- Engine 4 stroke engine , 125 cc

- Tape measure exhaust emissions, Stargas 898
- Measuring cup

The measuring process is performed using some following steps :

1. Preparation of equipment, materials and measuring instruments
2. Retrieval of data when using premium gasoline motors
3. Retrieval of data when using E10 fuel. At this step, the things you should do are:
  - Discharging fuel container
  - Mixing fuel
  - Fuel suction
  - Ignition for stationary stable condition
  - Data collection at some levels of engine speed, i.e. 1500, 3000 , 6000 and 9000 rpm
4. Retrieval of data for E20 fuel, the same treatment with step 3.

The data collection process should be done by an expert, in this case the technician and assistant of laboratory, as can be seen in Fig. 5.



Fig.5. Data collection process during exhaust emission gas testing

#### RESULTS AND DISCUSSION

During the experiment, the testing equipment used was a 4-stroke motorcycle engine of 125cc. The engine specification is shown in Table II, whereas the characteristics of gasoline and ethanol used can be seen in Table III.

Table II  
Engine Specification

	Part	
Engine	Bore x Stroke	52,4 x 57,9 mm
	Volume	124,9 cm <sup>3</sup>
	Compression ratio	9,0 : 1
	Valve	2 flaps, SOHC
	Valve in open	2° before TMA
	close	25° after TMB
	Valve exh open	34° before TMB
	close	0° after TMA
	Cylinder configuration	One cylinder 80° off vertical
Carburetor	Type of carburator	Type Piston Valve
	Diameter of venturi	18 mm or equivalent
	Diameter of manifold	23 mm
	Length of outer manifold	122 mm
	Length of inner manifold	77 mm

Table III  
Characteristics of Ethanol and Gasoline

Information	Unit	Ethanol CH <sub>1,814</sub>	Gasoline CH <sub>3</sub> O <sub>0,5</sub>
Heat	MJ/kg	26.9	44.133
Density of gass (1 bar, 25 °C)	kg/m <sup>3</sup>	1.214	1.227
Density of liquid (15,5°C)	kg/liter	0.79	0.7678
Boiling poin	°C	78	27
Self ignition	°C	423	257
Stoichiometry		9	14.7
RON		108	90-100
MON		92	81-90

After doing some experiments on exhaust emission gas using pure gasoline, E10, and then E20, the results shown in Table IV, V, and VI were obtained.

Table IV  
Gas emission test results using gasoline E0

Emission E0				
Rpm	CO (%vol)	CO <sub>2</sub> (%vol)	HC (ppm vol)	O <sub>2</sub> (%vol)
1500	1.65	7.83	596	6.27
	1.391	8.09	419	6.36
3000	2,074	8.98	207	4.59
	2.194	8.83	319	4.98
6000	3.531	8.28	99	4.59
	3.608	7.99	138	4.48
9000	0.940	9.43	194	4.94
	0.852	9.87	300	4.33

If it is desired to draw the data results of exhaust gas testing at certain engine speed and ethanol concentration of ethanol, the characteristics are shown in Fig. 6-9 for CO, CO<sub>2</sub>, HC, and O<sub>2</sub> concentration subsequently.

Table V  
Gas emission test results using gasoline E10

Emission E10				
Rpm	CO (%vol)	CO <sub>2</sub> (%vol)	HC (ppm vol)	O <sub>2</sub> (%vol)
1500	0.215	7.75	1693	9.5
	0.199	7.52	1055	9.48
3000	0.224	4.86	2122	13.97
6000	0.177	9.84	1060	6.02
9000	0.341	10.39	483	4.89

Table VI  
Gas emission test results using gasoline E20

Emission E20				
Rpm	CO (%vol)	CO <sub>2</sub> (%vol)	HC (ppm vol)	O <sub>2</sub> (%vol)
1500	0.762	7.97	714	7.88
3000	0.164	6.55	1536	11.12
6000	0.097	9.34	449	6.72
9000	2.038	8.75	471	5.72

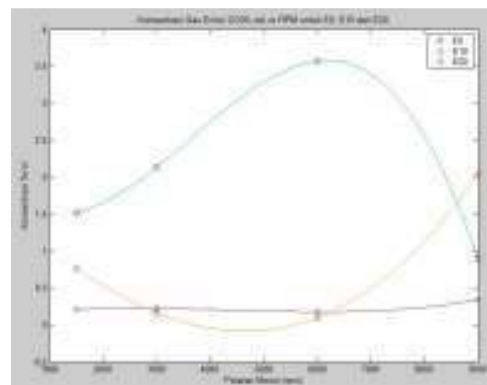


Fig. 6. Concentration of emission gas CO vs. rpm using E0, E10 and E20



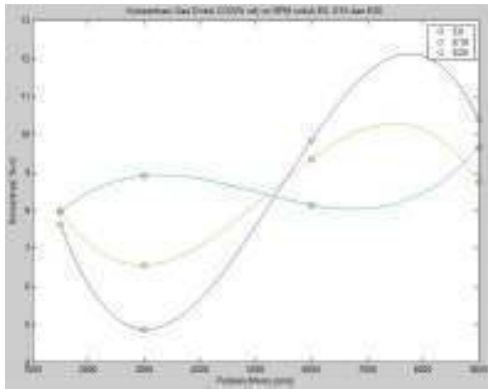


Fig. 7. Concentration of emission gas CO<sub>2</sub> vs. rpm using E0, E10 and E20

The concentration of CO emissions are decreasing after using the E10 and E20. However, at high engine speed the use of E20 will result in the continuing increase of CO gas, even higher than on the use of gasoline. This fact is reflected from the difficulty found during the testing, where it is hard to produce combustion using E20 containing ethanol-96%. The water content in the ethanol 96% could become the culprit of this difficulty. Combustion process becomes unstable and it was bursting several times. On the other hand, when E10 was used, the combustion process was normal. A setting one at the beginning is enough to produce good combustion condition at the other engine speed.

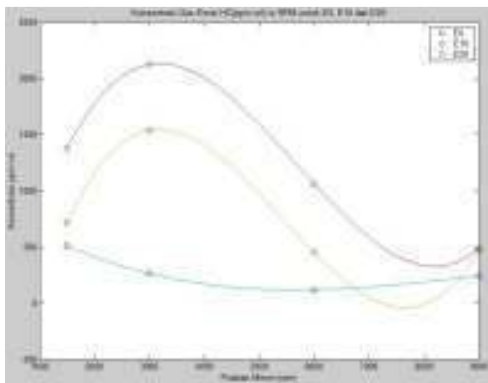


Fig. 8. Concentration of emission gas HC vs. rpm using E0, E10 and E20

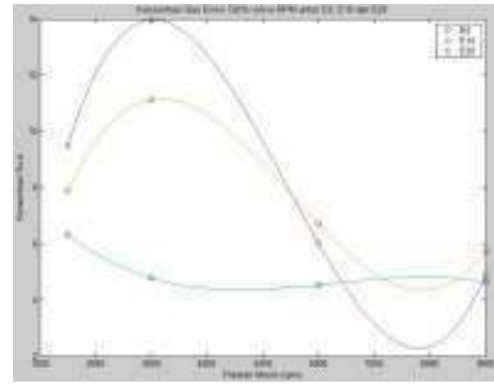


Fig. 9. Concentration of emission gas O<sub>2</sub> vs. rpm using E0, E10 and E20

## CONCLUSIONS

From the study conducted, some conclusions can be drawn as follows.

1. The mixture of ethanol of 96% concentration and gasoline of 88-octane (premium) with proportion of gasoline:ethanol to be 90:10 (E10) results in a normal combustion requiring only once carburetor settings at the beginning, at an engine speed of 1500rpm. On the other hand, the use of E20 arrangements requires repeated setting to produce the desired combustion, otherwise it will be difficult to turn on the engine.
2. The process of mixing ethanol-96% with gasoline does not result in a good mixture, as separation layer between the two is still visible being caused by the presence of water in the ethanol.
3. Design of MCU in the next research should enable to regulate the amount of flowing air to be mixed with the fuel.

## ACKNOWLEDGMENT

The authors would like to extend their gratitude to Rachmat, the technician of Design and Prototype Laboratory at the Electrical Engineering Department of Brawijaya University, and also to Eko Slamet and Hasan, both are the technician and the assistant of the Combustion Engine Laboratory at the Mechanical Engineering Department of Brawijaya University. Due to them, the experiment results of exhaust emission test can be presented in this study.

## References

- Rice, R.W., Sanyal, A.K., Elrod, A.C., Bata, R.M., 1991. Exhaust gas emissions of butanol, ethanol and methanol-gasoline blends. *Journal of Engineering for Gas Turbine and Power* 113, 337-381.
- Waytulonis, Robert., Kittelson, David., Zarling, Darrick, 2008, "E20 Effects in Small Non-Road SI Engines", Report to the Minnesota Department of Commerce, A literature and Information Search Center for Diesel Research, University of Minnesota.
- Wittawat Imerb1, Chinda Charoenphonphanich2\*, Pongsak Kummoool2, Nuwong Chollacoop3 and Katsunori Hanamura4, 2010, "Starting Characteristics of an Engine using Neat Ethanol ", The First TSME International Conference on Mechanical Engineering, 20-22 October, 2010, Ubon Ratchathani.
- Sitthiracha, Sitthichok, 2006, " An Analytical Model of Spark Ignition Engine for Performance Prediction" Thesis, Automotive Engineering, King Mongkut's Institute of Technology North Bangkok.
- Al-Farayedhi, A. A., Al-Dawood, A. M. and Gandhidasan, P. 2004, "Experimental investigation of SI engine performance using oxygenated fuel." *Journal of Engineering for Gas Turbines and Power*. Vol. 126 (2004) : 178-191.
- Boretti, Alberto, 2010, " Analysis of Design of Pure Ethanol Engine", University of Ballarat, Ballarat, Victoria, Australia.
- Pikūnas Alvydas Saugirdas Pukalskas, Juozas Grabys, "Influence of Composition of Gasoline – Etahnol Blends on Parameters of Internal Combustion Engine, *Journal of KONES Internal Combustion Engines* 2003, vol. 10, 3-4.

## A STUDY ON THE PERFORMANCE AND EXHAUST EMISSIONS OF A DI CI ENGINE FUELLED WITH DIESEL/LPG BLENDS

**Munzir Qadri**

Dept. of Mechanical Engineering, Faculty of Engineering,  
Universitas Muhammadiyah Jakarta, Jakarta, Indonesia  
flash\_mq@yahoo.com

### **Abstract**

*LPG is considered to be one of the most promising alternative fuels not only as a substitute for petroleum but also as a mean of reducing NOx, soot and particulate matter. In this experiment, LPG/diesel fuel blends with 10 wt% to 30 wt% of LPG added are studied in a single cylinder DI CI engine at both original and customized engine settings. Cetane improver is added to the L30D70 fuel blend by 0.3% and 0.7% to increase the self-ignition characteristics. The test is run at 1000 rpm, 1500 rpm and 2000 rpm with the load of 2 Nm, 5 Nm, 8 Nm, 11 Nm and 14 Nm. The effects of fuel properties, injection pressure and injection timing on the fuel economy and exhaust emissions of a diesel engine have been investigated.*

**Keywords:** Diesel engine, LPG, fuel blends, cetane improver, exhaust emissions

### **1. INTRODUCTION**

The DI Diesels' high fuel conversion efficiency and cheaper diesel fuel cost are the main driving factors for its wide popularity. However, fluctuating petroleum-fuel prices in the international market and associated environmental degradation have stimulated the researchers to develop various ways of developing clean diesel engines. LPG is considered to be one of the most promising alternative fuels not only as a substitute for petroleum but also as a mean of reducing NOx, soot and particulate matter.

Some researchers have developed new type of dual-fuel supply system which could be able to convert conventional diesel engine into dual-fuel engines like Diesel/LPG engines and Diesel/CNG engines. These engines are capable of operating on the diesel baseline mode or dual-fuel mode depending upon the requirements. However, when LPG is used in the conventional diesel engine, due to its lower cetane number, self-ignition is always a problem. Thus, if LPG is to be used as an alternative to diesel, the cetane number needs to be improved with additives or other positive means of initiating combustion. Various studies on alternative fuels

have been conducted for reducing consumption of Diesel fuel and important pollutant emissions such as nitrogen oxide (NOx) and particulate emissions (Snelgrove et al., 1996; Homeyer et al., 2002; Murillo et al., 2005). The CN and hydrocarbon content of Diesel fuel are very influential on the efficiency of combustion. The CN is increased by increasing the amount of paraffinic hydrocarbons and aniline nitrate in the fuel. As a result of increasing the CN, the ignition delay period is reduced and causes the engine to run steadily. However, a high CN above the standard value causes the formation of excessive smoke and reduces the engine performance. In the case of lower CN, it may be difficult to start the engine, and it causes it to run with the engine knocking (Icingur, Y. et al., 2002).

Generally, the diesel engine is the most efficient of all known types of internal combustion engines. Because of its high efficiency diesel engines offer the environmental benefit of low greenhouse gas emissions. A rough comparison shows 20% less CO<sub>2</sub> emissions than a modern gasoline engine (Amorese, et al., 2004). In addition to that CO and HC emissions are also low due to the lean burn combustion and high temperatures but because of the same reasons NOx emissions are considerable (Amorese, et al., 2004), (Heywood, 1988). However the diesel engine is a significant contributor to PM concentration in the atmosphere. Diesel PM is mainly the result of the heterogeneous nature of diesel combustion. The process of PM formation is initiated in fuel-rich regions inside the combustion chamber which leads to pyrolysis of the fuel and the formation of carbonaceous soot particles. Finally these particles stick together (agglomerate) to create visible smoke (Theodoridis, E., 2009).

According to Prasad, U.S.V. et al. (2012), Nature of Diesel engine combustion process is unsteady, turbulent, diffusion and heterogeneous, and due to these effects, the understanding makes more complex. The combustion process is highly influenced by the way of fuel-air mixing in the engine cylinder. One approach is to adopt a good

fuel injection system as it plays a crucial role to bring fuel and air in intimate contact with each other. The geometry of the nozzle in an injector plays a vital role in controlling diesel spray atomization and combustion. In order to bring fuel droplet size small, the nozzle-hole size is required to be reduced to produce smaller droplets. By decreasing the nozzle-hole size, the spray tip penetration is reduced due to the low spray momentum. High injection pressures with small nozzles are common in the modern diesel engine as they reduce injection duration and improve combustion efficiency. Numerical simulations were performed to study the effect of reduced nozzle-hole size and nozzle-tip hole configuration on the combustion characteristics of a high speed direct injection diesel engine. The fuel injection pressure in a standard diesel engine is in the range of 200 to 1700 atm depending on the engine size and type of combustion system employed (Heywood, J.B., 1988). When fuel injection pressure is low, fuel particle diameters will enlarge and ignition delay period during the combustion will increase. This situation leads to inefficient combustion in the engine and causes the increase in NO<sub>x</sub>, CO emissions. When the injection pressure is increased fuel particle diameters will become small. The mixing of fuel and air becomes better during ignition delay period which causes low smoke level and CO emission. But, if the injection pressure is too high ignition delay become shorter. So, possibilities of homogeneous mixing decrease and combustion efficiency falls down. Therefore, smoke is formed at exhaust of engine (Celikten, I., 2003).

In this experiment, the diesel fuel replaces most of the gaseous fuel, with only a small portion of cetane improver is used to increase the self-ignition.

## 2. EXPERIMENTAL SETUP AND PROCEDURE

The engine test for the blend fuel of LPG and diesel is divided into 2 stages, first stage is to study the influences of engine output and speed on fuel economy and exhaust emission under different torques and engine speeds. Three blending ratios are assigned, i.e. L10D90, L20D80 and L30D70 blend fuel. The basic engine parameters are unchanged. The plunger diameter of fuel pump is the original 7.5 mm. The injection nozzle diameter is 0.20 mm and the injection pressure is 196 bar, all are originally manufactured data. The original setting of 17° CA bTDC of injection timing is used.

The second stage is to study the effect of the change of fuel injection parameters on the engine fuel economy and exhaust emission under different torques and speeds. The blend fuel ratio used is L30D70 while the plunger diameter and injection hole diameter are unchanged. The injection pressure is lowered down to 157 bar as the different injection timings used are 13° CA bTDC and 17° CA bTDC.

The schematic diagram for the arrangement of the engine and test equipment in this study is shown in Fig. 2.1. The testing equipment includes engine dynamometer, dyno controller, intake system, fuel supply system, diesel engine, exhaust system, data acquisition and control system.

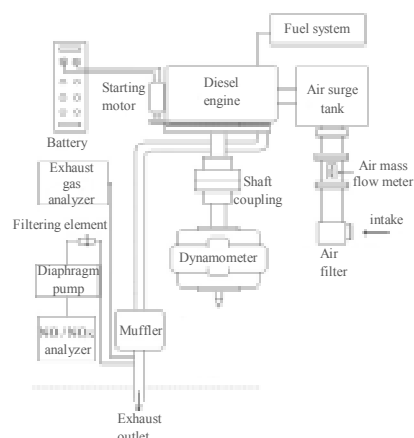


Fig. 2.1 Experimental configuration diagram of engine equipment

The diesel engine used is CHEN YU CY60F, which is Taiwan made version of YANMAR TF-60 engine.

Table 2.1 Factory specification of diesel engine

Model	CHEN YU CY60F
Type	Horizontal, water cooled, four stroke
Combustion	Direct injection, compression-ignition
Number of cylinders	1
Bore × stroke	75×80 mm
Displacement	0.353 L
Compression ratio	17.9
Continuous maximum horsepower(27°C)	5.0 hp / 2400 rpm
Injection timing	17° bTDC
Injection pressure	200 kgf/cm <sup>2</sup> (196.1 bar)
Plunger diameter	6.5 mm
Nozzle hole number and aperture	4×0.20 mm

Table 2.1 shows the specification of YANMAR TF-60. The engine is horizontal, single cylinder, four stroke, direct injection engine with a displacement of volume of 0.353 L and a compression ratio of 17.9. The original setting of fuel injection timing is 17° CA bTDC while the injection pressure is 200 kgf/cm<sup>2</sup> (196 bar). The maximum output of Taiwan made version CY 60-F has no formal data, but that of YANMAR TF-60 engine is 5 hp at 2,400 rpm.

The schematic diagram of LPG and diesel blend fuel system is shown in Figure 2.2. The system components include: (1) a nitrogen cylinder, (2) a diesel tank, (3) LPG storage container, (4) a filter, (5) a pressurized LPG-Diesel mixing vessel, (6) emergency shut-off valve, (7) high-pressure injection pump, (8) nozzle-holder assembly, (9) Diesel engine.

In this study, the fuel system of diesel engine is converted into LPG and diesel mixed fuel supply system. The blend fuel is pressurized and supplied at room temperature.

Since the saturation vapor pressure of LPG is about 5.2 bar at room temperature, the liquefied storage container must be kept at a pressure higher than 5.2 bar to remain in liquid form. The fuel blends used in this study are L10D90 (10 wt% of LPG and 90 wt% of diesel), L20D80, and L30D70 with the saturation vapor pressure at room temperature of 83.3 kPa, 133.9 kPa, and 167.8 kPa, respectively.

The mixing process of fuel blends is as follows:

#### Step 1

The 10.6 kg empty cylindrical tank is filled with 500 ppm of lubricant, Lubrizol 539M, for the purpose of lubrication. The same amount is applied on every different blend fuel ratios.

#### Step 2

Two mass percentages of cetane improver are then added, 0.3% for L20D80 and 0.7% for L30D70. There is no cetane improver used for L10D90.

#### Step 3

The amount of diesel fuel is measured by using a digital scale to get the required amount based on the assigned portion of LPG-diesel blend fuel. About 1.5 kg of diesel is added into the mixing tank of each blend fuel ratio due to the size of the mixing tank.

#### Step 4

Pressurized liquid LPG of 2.1~8.6 atm@20°C is drained into the mixing tank for 10%, 20% and 30% of LPG-Diesel mass ratios.

#### Step 5

After the mixing, the blended fuel is pressurized to 10~15 bar by N<sub>2</sub>. Then the blended fuel is left for about an hour to let the components of blend fuel dissolve to each other.

#### Step 6

Assuring the fuel line between the mixing tank and the engine is placed correctly below the mixing tank as well as installed properly from the outlet of mixing tank to the inlet of injection pump. Keep the inside of the line avoided from air or any other used fuel from the previous experiment, so that only the expected blend fuel flows in the line.

The test is run at three different engine speeds, 1000 rpm, 1500 rpm and 2000 rpm, respectively. The maximum speed assigned is 2000 rpm since the maximum engine speed of CHEN YU CY60F is limited to 2400 rpm. The torques applied are 2 N-m, 5 N-m, 8 N-m, 11 N-m and 14 N-m. These experimental conditions are applied to all blended fuels and engine settings.

Based on blended fuels and engine settings, the discussions are divided into two parts:

Firstly, the comparison of the results of fuel economy and exhaust emissions when using different fuel blends with additional Cetane plus at original engine settings of fuel injection, i.e. 196 bar injection pressure, 17° bTDC injection timing, 4-hole injection nozzle with 0.20 mm diameter. The different fuel blends include:

1. L10D90 blend fuel, i.e. the blend fuel of 10 wt% LPG and 90 wt% diesel fuel. The cetane number of L10D90 blend fuel is estimated to be 44.
2. L20D80 blend fuel, i.e. the blend fuel of 20 wt% LPG and 80 wt% diesel fuel. Additional 0.3 wt% of cetane improver is added to improve the ignition characteristics of L20D80 fuel such that the cetane number is estimated to reach a value of about 46.
3. L30D70 blend fuel, i.e. the blend fuel of 30 wt% LPG and 70 wt% diesel fuel. Additional 0.7 wt% of cetane improver is added to improve the ignition characteristics of L30D70 fuel such that the cetane number is estimated to reach an estimated value of about 46.
4. Diesel fuel with cetane number no less than 48.

Secondly, the comparison of the results of fuel economy and exhaust emissions when using L30D70 blend fuel with additional 0.7 wt% cetane improver on different customized engine settings of fuel injection:

1. 196 bar injection pressure, 17° bTDC injection timing, 4-hole injection nozzle with 0.20 mm diameter.

2. 196 bar injection pressure, 13°bTDC injection timing, 4-hole injection nozzle with 0.20 mm diameter.
3. 157 bar injection pressure, 17°bTDC injection timing, 4-hole injection nozzle with 0.20 mm diameter.
4. 157 bar injection pressure, 13°bTDC injection timing, 4-hole injection nozzle with 0.20 mm diameter.

The results are also compared with those of diesel fuel which use original engine settings of fuel injection.

### 3. RESULTS AND DISCUSSIONS

Fig. 3.1 to Fig. 3.3 show a comparison between fuel conversion efficiency, brake specific energy consumption (bsEC) and brake specific fuel consumption (bsfc) at 1000 rpm and original engine setting. It was found that the fuel conversion

efficiency  $\eta_f$  of diesel fuel is almost the highest among different fuels. As for fuel blends, L20D80 with 0.3 wt% cetane improver performs the second best  $\eta_f$ . The bsEC of diesel fuel was found the lowest, especially at light engine loads. Since the heating value is no longer an influencing factor of bsEC, other factors of thermal efficiency, combustion efficiency and mechanical efficiency should be then considered among different fuels. A common trend can be observed for each fuel that bsfc is the highest at the lowest engine load and decreases with the increase of engine load applied to the engine. This can be reasoned that the cylinder wall temperature increases due to more fuel burned within one cycle at a higher engine load. This would lead to a less cooling loss and a higher thermal efficiency, and finally, a lower bsfc of better fuel economy.

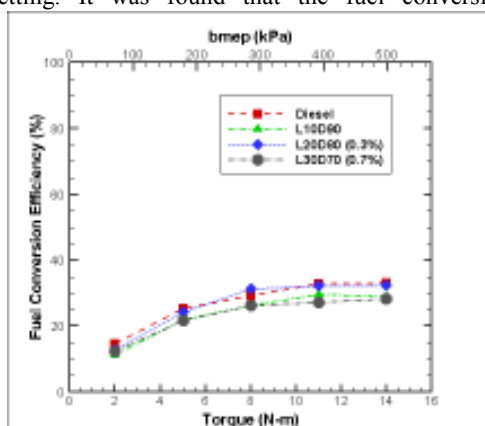


Fig. 3.1 Fuel conversion efficiency at 1000 rpm, original setting

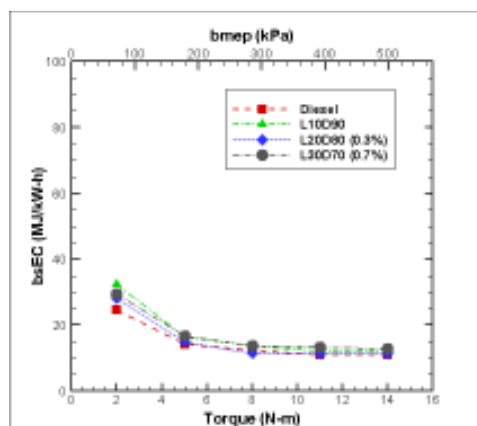


Fig. 3.2 Brake specific energy consumption at 1000 rpm, original setting

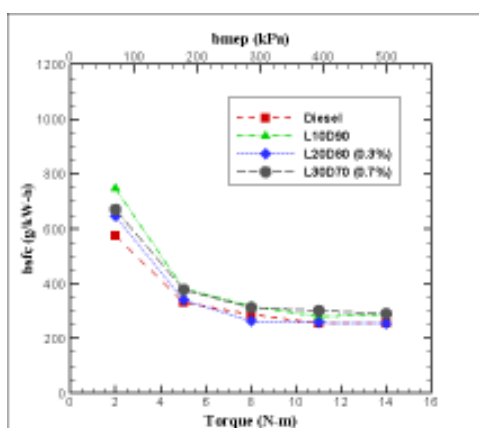


Fig. 3.3 Brake specific fuel consumption at 1000 rpm, original setting

Figure 3.4 to 3.6 show a comparison between brake specific nitrogen oxides (bsNOx), smoke and brake specific hydrocarbon (bsHC) at 1000 rpm and original engine setting. It was found that all fuel blends produce higher NOx than diesel. This may be explained by several reasons. The atomization of fuel blends would produce finer droplets due to their lower kinematic viscosity. The fuel blends have longer ignition delay than diesel due to lower cetane number than diesel fuel and the injection delay caused by smaller sonic speed. During ignition delay, more fuel blends evaporates and more premixed air-fuel mixture is prepared for fuel blends. When compression ignition occurs, the higher peak of heat release in the premixed burning

of fuel blends would cause higher peak temperature and larger formation rate of nitric oxide, NO. This would finally result in the higher bsNOx emissions of fuel blends than diesel. Among fuel blends, the smoke level of L20D80 is the highest, and is higher than diesel. The smoke level of L30D70 is the lowest, and is lower than diesel. The bsHC decreases with the increase of the brake torque applied to the engine. It is due to the cylinder wall temperature gets higher with the increase of amount of fuel burned. This would cause minor quenching of diffusion flame at the cylinder wall. Therefore less amount of unburned hydrocarbon is formed for higher brake torque output.

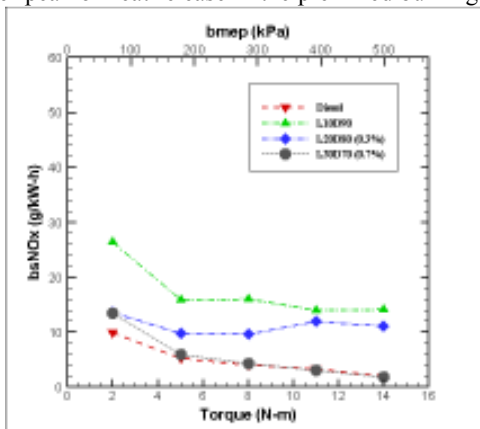


Fig. 3.4 Brake specific Nitrogen Oxides at 1000 rpm, original setting

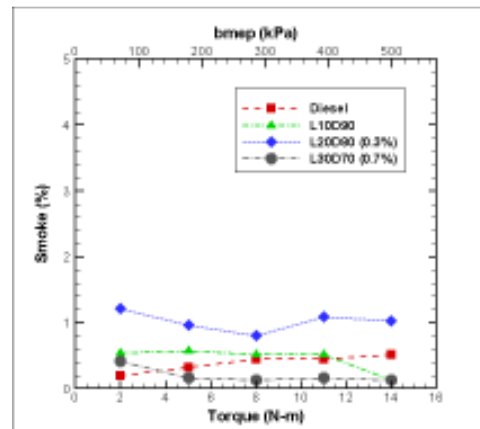


Fig. 3.5 Smoke percentages at 1000 rpm, original setting

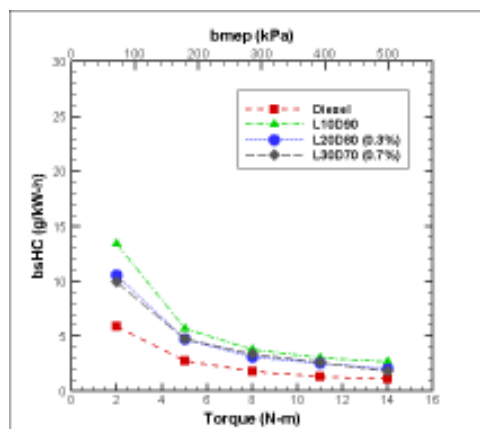


Fig. 3.6 Brake specific HydroCarbon at 1000 rpm, original setting

For different engine settings, Fig. 3.7 shows that at 1000 rpm, the energy consumption of diesel is higher than fuel blend. It is the fuel blend using the injection setting of 157 bar/13°bTDC that consumes the least amount of energy to produce work at most engine loads. It is also noticed that the

injection setting of 157 bar/17°bTDC consumes more energy than other settings at the lightest load and at heavier loads.

Fig. 3.8 shows that at 1500 rpm among different fuel injection settings, 196 bar/13°bTDC gives the highest amount of bsHC for all operating

conditions of different speeds and loads. The bsHC's of other fuel injection settings stay very close and is slightly higher than diesel at medium and higher brake torque output. It is noticed that the bsCO's of blend fuel at different fuel injection settings are all higher than diesel in all operation conditions.

Fig. 3.9 shows that at 1000 rpm, the combination of fuel injection setting 157 bar/17°bTDC of blend fuel gives the highest

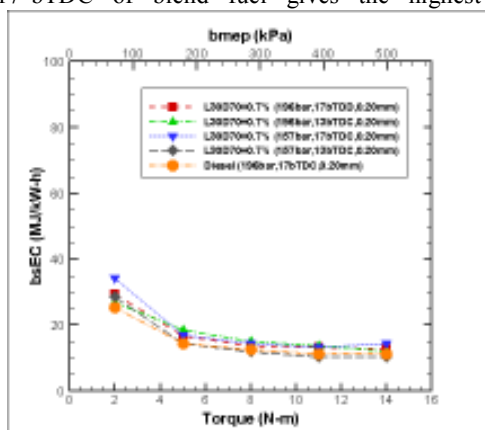


Fig. 3.7 Brake specific energy consumption at 1000 rpm, customized settings

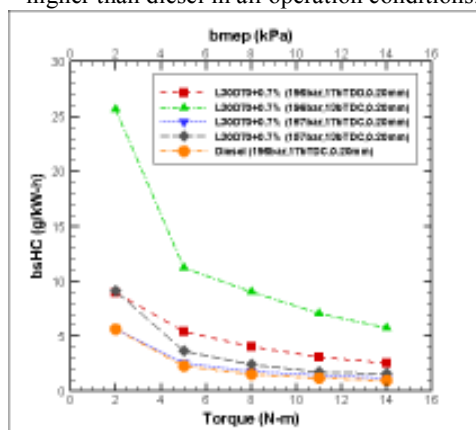


Fig. 3.8 Brake specific HydroCarbon at 1500 rpm, customized setting

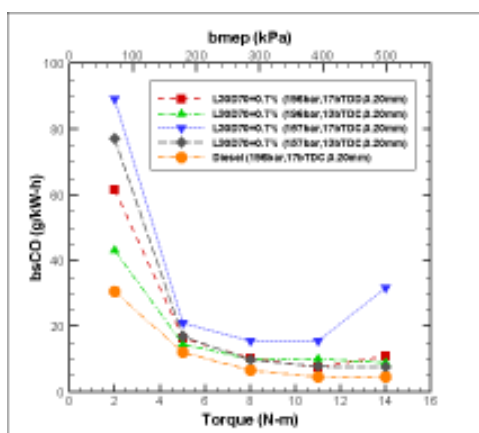


Fig. 3.9 Brake specific Carbon Monoxide at 1000 rpm, customized settings

#### 4. CONCLUSIONS

For original engine setting, the bsEC of diesel fuel is the lowest for all three engine speeds, especially at light engine loads. Since bsEC is the reciprocal of fuel conversion efficiency  $\eta_f$ , then the efficiency of transforming fuel energy of diesel into work is also experimentally found higher than all fuel blends. The fuel blend L30D70 with 0.7% of cetane improver produces the least amount of bsNOx at all engine speeds under all loads except 2 N-m. But at 1000 rpm, the amount of bsNOx produces is almost the same as that of diesel, it even becomes about two times that of diesel at 1500 rpm and 2000 rpm.

For different engine settings, the highest fuel conversion efficiency was reached by the injection setting of 157 bar/17° bTDC at 1000 rpm, but it reached the worst fuel conversion efficiency at the injection setting of 196 bar/13° bTDC. Noticeably, the lowest smoke level (even lower than diesel) is produced by the fuel blend using the original fuel injection setting of 196 bar/17°bTDC for all operation conditions. Rough and much higher data's of smoke level are obtained from fuel blend using the fuel injection settings of 196 bar/13°bTDC and 157 bar/17°bTDC.



## References

1. Amorese, C., De Matthaeis, S., De Mitchele, O., & Satriano, A., "The gaseous fuel option: LPG and CNG," *Proceedings of international conference on Vehicle alternative fuels and environmental protection*, Dublin, 2004.
2. Celikten, I., "An experimental investigation of the effect of the injection pressure on engine performance and exhaust emission in indirect injection diesel engine," *Applied Thermal Engineering*, 23: 2051-2060, 2003.
3. Heywood, J.B., *Internal Combustion Engine Fundamentals*, McGraw-Hill, New York, 1988.
4. İcingür, Y. and Altıparmak, D., "Effect of fuel cetane number and injection pressure on a DI Diesel engine performance and emissions," *Energy Conversion and Management* 44, Ankara, Turkey, 2003.
5. Prasad, U.S.V., Murthy, K.M. and Rao, G.A.P., "Influence of Fuel Injection Parameters of DI Diesel Engine Fuelled with Biodiesel and Diesel Blends," *International Conference on Mechanical, Automobile and Robotics Engineering*, Penang, Malaysia, 2012.
6. Snelgrove, D.G., Dupont, P. and Bonetto, R., "An investigation into the influence of LPG (auto-gas) composition on the exhaust emissions and fuel consumption of 3 bi-fuelled Renault vehicles," *SAE Paper No. 961170*, 1996.
7. Theodoridis, E., "Design And Investigation Of A Diesel Engine Operated on Pilot Ignited LPG," *PhD Thesis*, Cranfield University, United Kingdom, 2009.

## BUILDING AND DESIGNING CHEAP TELECOMMUNICATION SYSTEM FOR TENAGA KERJA INDONESIA (TKI)

Wahyu A. P.<sup>(1)</sup>,

<sup>(1)</sup>Teknik Elektro Fakultas Teknik Universitas Brawijaya  
Email wahjuapie@ub.ac.id

### Abstract

*TKI is Indonesia's biggest foreign exchange source. But oftenly, there are so many news about discrimination and violation to their TKI. TKI could not do anything since there is no communication media that TKI could use to contact their government and distributor. Thus, it is neccessary to create cheap telecommunication system using VoIP technology so their problem can be minimized. In this research, designing and instalation till testing has been done. It could be said that this prototype of cheap telecommunication system has been built with 3 communication mode, PC to PC, mobile phone to mobile phone and mobile phone to PC, which has capacity up to 3GB in stable condition.*

**Keywords:**TKI, VoIP, Commmunication, Cheap

### BACKGROUND

Indonesia's biggest foreign exchange comes from their Tenaga Kerja Indonesia (TKI) who is delivered to many developing country and great like United States of America, Australia, Malaysia, Timur Tengah and Taiwan. This worker have a purpose to get high salary, which rupiah has less value than another country, and there is no work field for them in their village. As the biggest Indonesia's source, the government of Indonesia should improve and grants extra high safety and controlling to their worker. The reason is this problem of TKI has became public secret which often appears in television, because of violation and etc. this could be happened just because TKI and government is seldom happened. It is maybe affected by high cost in doing telecommunication by telephone because roaming system. One of this research's goal is giving solution to that problem by doing "Building and Designing Cheap Telecommunication System for Tenaga Kerja Indonesia (TKI)".

The communication, which want to be researched, is using VoIP (*Voice over Internet Protocol*), that serve voice calling by data service (internet). This communication technique is developed using android based device. Android

based device is chosen because it is *open source*, so user do not need a license to operate and enjoy the service. In the other hand, Android device, that is used, must be connected to SIP (*Session Initiation Protocol*) which data service could be granted by buying some offers of data packet than users using conventional offers.

By that prologue, so this research will design prototype of cheap telecommunication system which has relative cheaper cost for TKI. Next hope is by implemented this system, TKI's problem, which is happenened because there is less media to communicate to the government and others, can be minimized.

### LITERATURE REVIEW

In this literature review described some of the results of previous studies related to the research of VoIP. VoIP research has been done related research include the use of VoIP in the WLAN network and VoIP implementations using a voice scrambler enhancement as an additional security tool.

VOIP network designed in previous studies form a Wireless Local Area Network. By using a network configuration infrastructure basic service set, which consists of one access point, 1 server, 1 client and mobile phone client 5 in the form of laptops. Parameters were observed between the other end to end delay, jitter, packet loss, and network capacity. To get the values of the parameters analyzed with the help of Wireshark software. In implementation, a score is the highest for end to end delay with 2 clients at 157.2 ms and 184.2 ms for 6 client, and the highest score of jitter for 2 clients is 28.462 ms and 36.492 ms for 6 clients, the highest percentage loss packet value when the 2 clients reaches 0,116% and 6 clients reaches 0.178%. And found that the number of active clients that can use VOIP services on the network amounted to 91 clients simultaneously.

Application of the method to take advantage of the TMS320C6713 voice scrambler in SIP - based VoIP services to design hardware components consist of a scrambler, VoIP, and translator. Then a software design methods with a voice scrambler constituent algorithms are applied

to the TMS320C6713, as well as client and server on a VoIP service. The results of testing the application of the method as a supporting voice scrambler securities in SIP-based VoIP by using TMS320C6713 obtained that information has been tapped signal at a different frequency with a reference signal 500 Hz sine signal and the human voice. The performance of the application of the method of voice scrambler has the processing time of 0.18177 s, while the performance of voice scrambler on a VoIP network throughput value obtained at 249.3571 packets/s, the value of delay which is divided into packetization delay, encapsulation, decapsulation, transmission, propagation, and queue values obtained in a row of 40 ms, 47.1 ms, 47.1 ms, 1:37 ms, 0.156x10<sup>-3</sup> ms and 0172 ms, while packet loss is obtained a value of 0%.

## BASIC THEORY

In the basic of this theory will be discussed about VoIP, SIP, VoIP Voice Coding, PPP and international roaming rates.

*VoIP*

Voice over Internet Protocol (VoIP) is a technology that is capable of passing voice traffic, in the form of packets over the network Internet Protocol (IP). IP network itself is a data communications network based packet-switch. Bundled voice signal prior experience coding or changing voice sound format into a digital form that can be passed through an IP network. IP Telephony, Internet Telephony, or termed VoIP (Voice Over Internet Protocol) is a technology that uses IP (Internet Protocol) to provide voice communication in real-time.

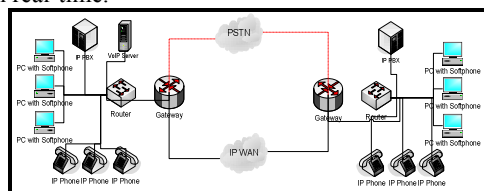


Figure 1.VoIP Networks

(Source : Sinnreich, Henry, 2006: 25)

### Session Internet Protocol (SIP)

SIP (Session Initiation Protocol) is an application layer protocol recommended by IETF (Internet Engineering Task Force). Architecture SIP is a SIP-based service environment forming a distributed and scalable. In addition, it can be integrated with other IETF standard protocols to create SIP-based applications. The concept of SIP architecture is shown in Figure 2 below:

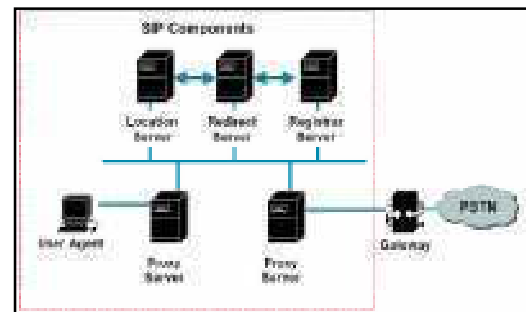


Figure 2. SIP

(Source : Johnston, Alan B, 2001: 48)

## Voice Coding VoIP

ITU-T (International Telecommunication Union-Telecommunication Sector) made several standard for voice coding recommended for VoIP implementations. Regulations G.711 is an international standard for audio compression technique using Pulse Code Modulation (PCM) in the delivery of voice. This standard, as in table 1, widely used by the telecommunications operator as a standard in analog to digital voice coding.

Tabel 1. ITU-T Standart of Compression

Teknik Kompresi	Bit Rate (kbps)	Sample/ Frame Size (ms)	Ukuran Voice Payload (Bytes)	Frame /Paket	MOS
G.711	64	20	160	1	4.1
G.726	32	20	80	1	3.85
G.728	16	2.5	60	4	3.61
G.729	8	10	20	2	3.92
G.723.1a	6.3	30	24	1	3.9
G.723.1b	5.3	30	20	1	3.65

(Source : [http:// www.newport-networks.com/VoIP-Bandwidth.pdf](http://www.newport-networks.com/VoIP-Bandwidth.pdf) )

### Point-toPoint Protocol (PPP)

Point-to-Point Protocol (PPP) is a data link protocol that is part of the TCP/IP protocol. This protocol describes how the data is transmitted between two machines end point through communication media such as telephone lines.

Configuring PPP is divided into two, namely the switched-access or dial-up configuration, and hardwired or leased-line configuration. In the leased-line configuration, PPP involves two peers that are connected to each other. This pathway consists of a switched or unswitched digital service leased from a provider and is usually connected to an ISP or other small sites. In this pathway, the service will always be connected between peer, unless the system administrator or system power failure. Leased-line configuration uses synchronous and asynchronous communication.

with the addition of a common unit of synchronous systems such as SPARC (Scalable Processor Architecture).

#### Rates

Rates are international roaming rates charged to customers because of the relationship that had crossed the line of communication network caused by the change of service from the Home Network to Other Network. Understanding the Home Network is defined as a network where the customer number is published, while other areas will be a network for roaming. International roaming rates can be done if there had been cooperation between mobile operators across the country so that customers can use the operators of a country different service operators in other countries to do the communication. Given these rates, telecom service providers can continue to provide services to customers despite the customer's needs have exceeded the service infrastructure owned by an operator.

#### METHODS

The steps of research that will be conducted is represented in figure 3 below:

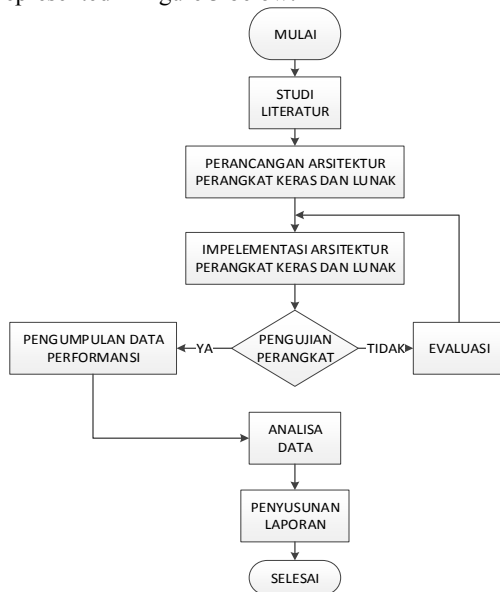


Figure 3. Methods Block Process

#### Literature

Literature review related to theories supporting the implementation is done at this stage using the supporting text books, journals IEEE, the results of previous studies, ITU-R and other materials that have a relationship with this research.

Data used in the preparation of this study include primary data and secondary data.

#### Designing

The design of the block diagram is used as a reference for the design of SIP-based VoIP server with G.729 codec, so that the system can operate for data communication with G.729 compression. Block diagram compiled consisting of mobile equipment, access points, servers (G.729 codec module), routers, Internet network (figure 4).

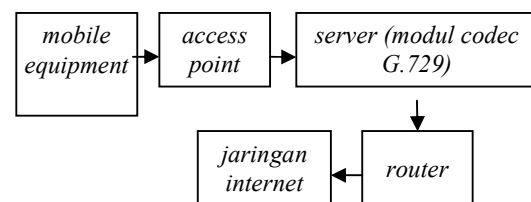


Figure 4. Block Diagram of VoIP System using Codec G.729

The design of the hardware in the system is done by determining the specifications and functions on each device to establish a system which includes:

1. Design and specification of mobile equipment determination as user-owned mobile devices on a VoIP service.
2. Design and specification determination computers (PCs) as G.729 codec module and a server on the VoIP service.
3. Design and specification determination of UTP cable and RJ-45 as a transmission medium in VoIP services.
4. Design and specification determination of the NIC as a connect between the computer and the transmission medium used.
5. Design and specification determination of the access point as a connecting each client to establish a VoIP network.
6. The design and specification of the router as a regulator determination addressing VoIP network to connect to the Internet.

Hardware design is done with reference to the specification of the required system. For the hardware design steps are as follows:

- Making a block diagram of the hardware.
- Hardware design of each block which includes planning and determination of specifications that support each other to build a system that has been designed.
- Combining a few blocks into the overall system is planned.

In this section designed hardware support in one unified block diagram that has been planned.

The software is designed to run and connect a particular hardware with other hardware. Software design in this study focused on compressing voice data on VoIP using G.729 codec algorithm module as a data compressor in order to obtain bandwidth saving voice channels. The design of the software required is:

1. Design algorithms G.729 codec.
2. The design of the client and the server on a VoIP network.

### Testing

Tests performed on each block diagrams as well as the overall block diagram that has been designed. Tests on each block is done to see the performance and results on every block, and then do the analysis to see how successfully the system to overcome some calls in real time. Test data taken directly from the subject.

### Widely Analysis

Analysis of the research aims to determine the entire system can work well in SIP-based VoIP network with G.729 codec. In this study, analysis of systems described include:

- Analysis of the relationship between hardware and software across the network with a SIP-based VoIP G.729 codec.
- Analysis of the performance of a system built on SIP-based VoIP network with G.729 codec.
- Analysis results commissioning testing system that includes: delay, jitter, and latency.

The results of the analysis in this section is used partly as a reference to draw conclusions and suggestions for further research.

### Conclusions Drawn and Suggestions

Conclusions drawn based on the results of the design, testing and analysis of communication systems in VoIP (Voice over Internet Protocol)-based SIP (Session Initiation Protocol) with the G.729 codec. While the suggestions is about the development of the existing system.

## RESULTS

### Activity

Activities that have been carried out, among others, identify the type of server that is used to obtain the maximum results in the application of VoIP. The results of the survey obtained some necessary specifications primarily coding system used in the processing of voice codec is G.729.

In this activity the findings of a review of the literature in relation problems derived from the survey results, associated with the equipment will be designed. In this activity conducted literature searches in the library, manually, or electronically via the Internet. Results obtained in the form of circuit types and their server racks required, the components used, rack servers, as well as the characteristics of the type of server and device used. The network configuration is obtained as follows,

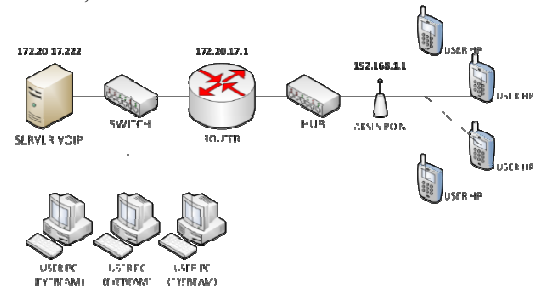


Figure 5. Configuration of the Desired System

Then, the configuration obtained from the function of each device to support the performance of the system. The function of each device are summarized in the table below,

Tabel 2. Device

No	Hardware	Function
1	Server VoIP	Provide voice services on the client and Internet protocol for processing voice data with G.729 voice compression (G.729 codec module)
2	User PC	As a VoIP client on a network that uses the eyeBeam softphone user interface.
3	Switch	Liaison between the network choose the path in the network according to the addressee by the data sent.
4	Router	Liaison between the network that directs the data only on lines that match the address and protocol used.
5	Hub	Connecting network devices.
6	Access Point	Connecting the wire-line devices with wireless mobile devices, in this case Android phone model.
7	User Handset	Android mobile phone as a mobile VoIP client on a network that uses a user interface Bria Android
8	Cloud	Connecting VoIP systems to the Internet

After carrying out the configuration design, implementation and installation activities performed either from hardware to software. The design includes mechanical hardware, electrical to

electronics. Implementation of the mechanical rack mount server is as follows,



Figure 6. Mechanic- Rak Server Raja Rack 19  
Wallmounted 8u 500mm

Then for electrical implementation is determining the layout of electrical equipment, terminals and parking socket and connector specification.

At this stage, the procurement of the necessary electronic devices in this study. Integrated device as in Figure 5 above. Electronic devices include:

Server-selected server device must be able to process sound with G.729 voice compression and also must have a great specification that mass communication (> 100 conversations) can be done.



Figure 7. Server HP Proliant

UPS-UPS device selected must be able to generate a steady voltage, the voltage changes that may occur. Additionally, is able to provide sufficient energy reserves when power cuts occur within a short time.

Router-router device selected must be able to work optimally when communication services greater than 100 conversations.



Figure 8. Router RB1200 1U (Rent)

Handset-Handset Devices serves as the user moves the client (mobile). This device works in wireless networks that have high data rates. This device also operates at a minimum ampu SIP protocol for voice communications.



Figure 9. Android Mobile Phone (Rent)

After holding the hardware, software needed include: debian linux software Trixbox, eyeBeam and Bria PC on a mobile phone.

### All Systems Installation

Merger between the hardware with one another in order to synergize into a communication-efficient operating systems that use the G.729 codec. This has been done peering between Internet network with a router, the router with the server, the server with an access point, the client and the server.

### Testing

Activities that have been performed is testing composed of hardware, software and installation (implementation) VOIP system. Details of the activities that have been implemented are: Hardware Testing (includes mechanical, electrical and electronic), Software Testing (includes provision of traffic load), Overall Testing (includes testing the system using additional software, ie VQManager).

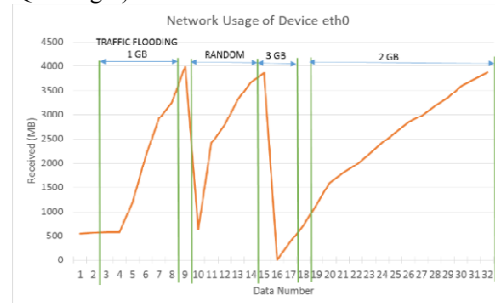


Figure 10. Graphic of VoIP Network Usage by  
Vary Traffic.

In Figure 10, it appears that the Android system is constructed able to handle the traffic load of up to 2 GB (Traffic Flooding). This case, the curve obtained from the VoIP system when traffic load is worth 3 GB, a decline in the performance of the system. The decline occurred in the data to the data-14 to 17th. But when the traffic load was lowered to 2 GB, the performance of the system back up and data received by the server is increasing as well.

### Obstacle

In the implementation of this study, there was little resistance. Barriers in the form of disbursement of funds from the center of late and rising exchange rate. Late release of funds to make our team agreed to temporarily lease hardware possible. The increase in foreign exchange rates can not be avoided, saving to finance is this research necessary.

In addition, the use of the public address that until now have not been able to do because of the need to hit the licensing regulations. Regulation that addresses the communication-efficient communication has not been published because of the use of saving feared to be detrimental to cellular operators. This limitation makes our team agreed to conduct local-scale research at Universitas Brawijaya.

### CONCLUSIONS

Research at this stage aims to build a network base with a low voice communications system utilizing SIP (Session Initiation Protocol) service based on VoIP (Voice Over Internet Protocol) to rent a channel bandwidth (Leased Line) with the following achievements:

1. Mechanical installation hardware has been proceeding according to plan.
2. The use of software Trixbox server can handle device operation.
3. Use of eyeBeam 1.1 softphone software can handle the client device operating.
4. Use of Bria 1.2 android software can handle the client device operating
5. Types of cables and connectors are used as a bridge between the hardware devices can support the operation of the device according to the plan.
6. Wiring connectors are not perfect (less dense, less good cable type) affect the continuity of the communication systems between devices.
7. The use of G.729 codec algorithm has been able to run well and successfully handles two client calls.
8. The integration of the device has been successfully done so that communication can take place between two clients to 200 clients (100 conversations with server capacity up to 2 GB).

### References

- Anonim. 2010. "Hak Berkomunikasi Bagi TKI Perlu Dijamin". *Berita Hukum*, 27 Januari [Online]. [www.hukumonline.com/berita/baca/1t4b5fef7a3bd20/tki-komunikasi](http://www.hukumonline.com/berita/baca/1t4b5fef7a3bd20/tki-komunikasi) [accessed date 17 Maret 2013, 03.00 WIB].
- Anonim. 2011. "TKI Berhak Komunikasi Dengan Keluarga". *Pos Kota*, 10 Maret [Online]. [poskota.co.id/berita-terkini/2011/03/10/tki-berhak-komunikasi-dengan-keluarga](http://poskota.co.id/berita-terkini/2011/03/10/tki-berhak-komunikasi-dengan-keluarga) [accessed date 17 Maret 2013, 03.00 WIB].
- Anonim. 2013. *International Direct Dial - Value Call Rates (IDD132)* [Online]. [www.maxis.com.my/idd132/index.asp?iStruct=0:4:0](http://www.maxis.com.my/idd132/index.asp?iStruct=0:4:0) [accessed date 17 Maret 2013, 09.00 WIB].
- Anonim. 2013. *Perluas Cakupan Jaringan Sistem Komunikasi Kabel Laut* [Online]. [www.indosat.com/Public\\_Relations/.../Perluas\\_Cakupan\\_Jaringan\\_Sistem\\_Komunikasi\\_Kabel\\_Laut](http://www.indosat.com/Public_Relations/.../Perluas_Cakupan_Jaringan_Sistem_Komunikasi_Kabel_Laut) [accessed date 17 Maret 2013, 07.00 WIB].
- Anonim. 2013. *Sambungan Langsung Internasional 007* [Online]. [www.telkomsel.com/services/sambungan-langsung-internasional/1650-SLI-007.html](http://www.telkomsel.com/services/sambungan-langsung-internasional/1650-SLI-007.html) [accessed date 17 Maret 2013, 07.00 WIB].
- Anonim. 2013. *Submarine Cable System* [Online]. [www.indosatsingapore.com/infrastructure.html](http://www.indosatsingapore.com/infrastructure.html) [accessed date 17 Maret 2013, 09.00 WIB].
- ICN. 2011. Perkembangan Industri Telekomunikasi Seluler di Indonesia-2011. *Indonesian Commercial Newsletter (ICN)* [Online]. [www.datacon.co.id/Telekomunikasi-2011Industri.html](http://www.datacon.co.id/Telekomunikasi-2011Industri.html) [accessed date 17 Maret 2013, 07.00 WIB].
- Johnston, Alan B.2001. "SIP-Understanding The Session Initiations Protocol". United States:Artech House,Inc.
- Sinnreich, Henry. 2006. "Internet Communications Using SIP: Delivering VoIP and Multimedia. Services with Session Initiation Protocol, Second Edition".United States:John Wiley&Sons,Inc.
- Sundari. 2012. "Pemerintah Tetap Akan Kirim TKI ke Malaysia". *Tempo*, 16 November [Online]. [www.tempo.co/read/news/2012/11/16/078442172/p-Pemerintah-Tetap-Akan-Kirim-TKI-ke-Malaysia](http://www.tempo.co/read/news/2012/11/16/078442172/p-Pemerintah-Tetap-Akan-Kirim-TKI-ke-Malaysia) [accessed date 17 Maret 2013, 03.00 WIB].

## DC MOTOR SPEED CONTROL USING DYNAMIC LINEAR QUADRATIC REGULATOR (LQR)

Dwi Ajiatmo<sup>1,2</sup> and Imam Robandi<sup>3</sup>

<sup>1)</sup>Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya 60111  
Indonesia, email: ajiatmo12@mhs.ee.its.ac.id.

<sup>2)</sup>Department of Electrical Engineering, Faculty Engineering of Darul 'Ulum University  
Jombang 61413 Indonesia, email: ajiatmo@gmail.com

<sup>3)</sup>Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya  
60111 Indonesia, email: robandi@its.ac.id

### Abstract

*Optimal performance value on a dc motor. The use of linear quadratic regulator (LQR) in the optimization of a DC motor speed control, based on the achievement of the weight matrix  $Q$  value and weight value matrix  $R$ . As a basis for determining the value of the feedback matrix  $K$  and the value of the tracking matrix  $L$ . From the simulation results on the tuning of the controller in DC motor speed control with linear quadratic regulator (LQR) obtained on condition that the Open Loop: Rise Time: 0, settling time: > 16.9 seconds, 0% Over shoot, PID: Rise Time: 0.0741, Settling time: 7.6 seconds, Over shoot: 90%, LQR: Rise time: 3.1, Settling Time: 5.62 Over shoot: 0%.*

**Keywords:** DC motor, PID, LQR method

### INTRODUCTION

That the most important part in the design of the control system performance specifications are stated correctly so as to produce an optimal control system for desired destination. The concept of optimization of the control system compromising performance index selection and design that will result in optimal control. Index performance is very important because it determines the nature and behavior so obtained optimal control, control may be obtained by linear, stationary, or time-varying, it all depends on the shape of the performance index. [7]

### MATHEMATICAL MODEL OF DC MOTOR.

In the IEEE dictionary mathematical model of a system is defined as a set of equations that are used to represent the physical system. [2]

In many industries the world of DC motors are used. DC motor speed advantage is a better, simpler structure, higher reliability and easier maintenance. Characteristic equation of a DC motor is described as follows: [7]

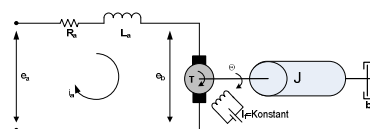


Figure 1. Representation of a DC motor circuit equation system

$$e_a = L_a \frac{di_a}{dt} + R_a i_a + e_b \quad (1)$$

$$e_b = K_b \omega = K_b \frac{d\theta}{dt} \quad (2)$$

$$T = K_T i_a \quad (3)$$

$$T = J \frac{d\omega(t)}{dt} + B \omega(t) \quad (4)$$

LQR system is built by changing state space into the transfer function, from equation 1, 2, 3 and 4 obtained by the DC motor mathematical modeling equations as follows:

$$\frac{d}{dt} i_a(t) = -\frac{R_a}{L_a} i_a - \frac{K_a}{L_a} \omega + \frac{1}{L_a} e_a \quad (5)$$

$$\frac{d}{dt} \omega(t) = -\frac{K_T}{J} i_a(t) - \frac{B}{J} \omega(t) \quad (6)$$

That we know to be able to design a control system with linear quadratic regulator method, is the first step that we can describe a form of state space of a DC motor. Equation 5 and equation 6 can be a portrait of a state variable DC motor. [7]

In the table below is the motor data to be used as a simulation and analysis.

Table 1. Data DC motor [1]

Symbol	Value and Unit
Momen inertia, J	0.01 kgm <sup>2</sup> /rad
Viscous Friction Coefficient, B	0,1 kgms/rad
Factor Torsi constant, K <sub>T</sub>	0.01Nm/A
Back emf constant, K <sub>b</sub>	0.01Vs/rad
Resistance armature, R <sub>a</sub>	1 Ω
Inductivity armature, L <sub>a</sub>	0.5H



### LINEAR QUADRATIC REGULATOR (LQR)

The technique of linear quadratic regulator design system is a part of a modern optimal control theory has been applied mainly in the industrialized world. [3-6] In general, the model state space system of equations is: [7]

$$\dot{x} = Ax + Bu \quad (7)$$

Optimal design of a linear quadratic regulator control method is to reduce the performance index so that it has a minimum value to achieve the final performance can be accepted by the system. On the control of linear quadratic regulator design, performance index (J) is;

$$\dot{u} = -Kx \quad (8)$$

Where K is the optimal feedback gain matrix and determine minimizing the performance index in equation (9). Feedback gain matrix K depends on the matrix A, B, Q, and R. There are two main equations that must be taken into account to achieve the feedback gain matrix K is the equation:

$$A^T P + PA - PBR^{-1}B^T P + Q = 0 \quad (9)$$

Where P is a symmetric positive definite matrix and the known solutions Algebraic Riccati Equation (ARE), the feedback gain matrix K is:

$$K = T^{-1}(T)^{-1}.B.P \quad (10)$$

$$K = R^{-1}B^T P$$

Substituting equation 10 into equation 7 derived:

$$\dot{x} = Ax + BKx = (A - BK)x \quad (11)$$

By using a matlab program from the state matrix equation 7 can be searched DC motor speed control behavior. Large dimensions of the matrix Q based on the number of auto-dimensional state matrix A and matrix Q is the identity matrix of dimension 2 x 2 matrix, and the dimension of the matrix R is based on the number of entries of the matrix B, where the matrix R is a constant equal to 1.

### SIMULATION AND RESULTS

With the help of matlab program and data DC motor, the simulation results obtained as follows:

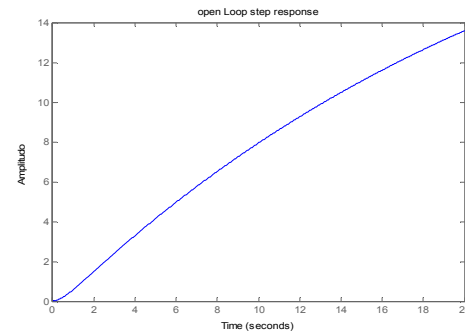


Figure 2. Step Respond Open Loop system

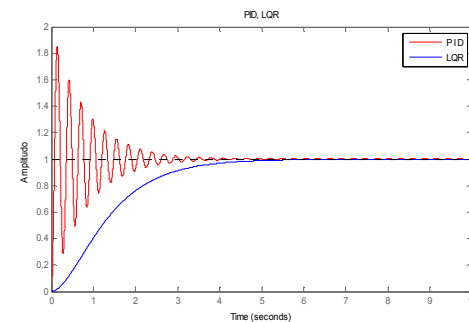


Figure 3. Step Respond PID and LQR System

The results of simulation analysis on settling time, rise time and overshoot of the Open Loop, PID and LQR are presented in Table 2.

Tabel 2. Simulation Result

	Rising Time (s)	Settling Time (s)	Over shoot (%)
Open Loop	0	>16.9	0
PID	0.0741	7.6	90
LQR	3,1	5,62	0

### CONCLUSION

From the simulation results of the analysis and optimization of the speed of a DC motor with Linear quadratic regulator (LQR) can be obtained on conditions inferred Open Loop: Rise Time: 0, settling time:> 16.9 seconds, Over shoot: 0%, PID: Rise Time: 0.0741, Settling time: 7.6 seconds, Over shoot: 90%, and when optimized with LQR: Rise time: 3.1, Settling Time: 5.62, Over shoot: 0%.

#### Reference

- [1] Robert Babuika and Stefano Stramigioli, 1999, ***Matlab and Simulink For Modeling and Control***, November 1999, Delft University of Technology.
- [2] IEEE Standart Dictionary of Electrical and Electronic Terms, New York, IEEE, 1984
- [3] Heru Dibyo Laksono, 2008, ***Simulasi Pola Tingkah Laku Kecepatan Motor DC Di Titik Operasi Menggunakan Metoda Linear Quadractic Regulator (LQR)***, Jurnal TeknikA No. 29 Vol.2 ISSN: 0854-8471. Tahun. XV April 2008.
- [4] Ruba M.K. Al-Mulla Hummadi, 2012, ***Simulation Of Optimal Speed Control For a Dc Motor Using Linear Quadratic Regulator (LQR)***, Journal of Engineering, Number 3, Volume 18 march 2012, Baghdad.
- [5] Aamir Hashim Obeid ahmed, 2012, ***Optimal Speed Control for Direct Current Motor Using Linier Quadratic Regulator***, Journal of science and Technology, Vol. 13, ISSN 1605-4278, December 2012, Sudan.
- [6] Ahmad A. Mahfouz, 2013, ***Modeling,Simulation And Dynamics Analysis Issues Of Electrical Motor, For Mechatronics Application, Using Different Approaches And Verification By Matlab/Simulink***, Intelligent Systems and applications, 2013, 05,39-57, Published online April 2013 in MECS.
- [7] Katsuhiko Ogata, 1990, ***Modern Control Engineering***, Second Edition, Prentice Hall International Editions, USA.

## OPTIMIZATION OF PID CONTROLLER AND DUAL INPUT POWER SYSTEM STABILIZER IN ELECTRICAL SYSTEM USING FIREFLY ALGORITHM

Mhd Fany<sup>1)</sup> and Imam Robandi<sup>2)</sup>

<sup>1)</sup> Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya  
Indonesia 60111, email: fany09@mhs.ee.its.ac.id

<sup>2)</sup> Department of Electrical Engineering, Faculty of Industrial Technology ITS Surabaya  
Indonesia 60111, email: robandi@its.ac.id

### Abstract

*Disturbance of power system always causes instability. One of the causes of instability is change of load dynamically. The dynamic changes is a load changes on instantaneous time and periodically. The disturbance couldn't responded well by generator so it could influence the dynamic stability of system. The solution of dynamic stability is seeing stability of system around the stability node. That changes can be small load changes, like an increasing and decreasing of load. The disturbance can influence the oscillation of the system can be loss of synchronous. Solution of the problem is the generator use adding controller that install at exciter. To get well performance, the frequency setting on generator added by Proportional-Integral-Derivative (PID) Controller. Besides of PID Controller, oscillations can reduced by DIPSS that reduce of signal noise in order to stability system. This research is a concept of SMIB coordination which is controlled by PID and DIPSS that optimized with FA Artificial Intelligence. Hopefully this method can reduce frequency oscillations because of load changing. This research use MATLAB2010 software.*

**Keywords:** Dual Power System Stabilizer, Firefly Algorithm, Dynamic Stability, PID, SMIB

### 1. INTRODUCTION

The power system which is disturbance will lead to system stability. The disturbance can be an increase and decrease in load suddenly, breaking up the line, overload or short circuit. Changes in load that occurs suddenly and periodic can't be responded properly by the generator so that it can affect the dynamic stability of system. This is causes oscillation frequency on generator. The unfavorable response can cause oscillation frequency in a long period. It will lead to a reduction in the capacity of power transfer. These problems occur on systems with one machine.

The dynamic stability of the power system, is a study of the stability which is assumes governor's response. This is due to the governor's response compared response of excitation system is very slow. So, on the dynamic stability of systems, the controller is added to a system of excitation. The addition of amplifier on excitation system less able to stabilize the system especially when peak load. A modifier signal additional to improve damping on peak load state can solve the problem.

This equipment also known as auxiliary equipment. This research proposed additions auxiliary equipment. They are Proportional-Integral-Derivative (PID) Controller and Dual Input Power System Stabilizer (DIPSS). In the use of DIPSS, the optimal parameters are very influential in stabilizing the system. The ranges of parameters from equipment is quite large, then to obtain the value of parameter quickly used optimization method. This research uses Firefly algorithm. The response of system known by analyzing overshoot and settling time values, while for objective function using *Integral Time Absolute Error* (ITAE).

### 2. SYSTEM MODEL AND ALGORITHM Power System Stability

Stable power system has a balance between mechanical input power (prime mover) and electrical output power. In these circumstances the generator rotates in synchronous. When the load is increasing or decreasing, it must followed by the change of the mechanical power from the prime mover. If the change is not followed by a change of mechanical power to meet the load and system losses, then there will be instability. Generator rotor speed (frequency) and the voltage will deviate from the normal state. Shortly, there will be curbs between the input power from the prime mover with the output power of the generator, especially when there is a disturbance.

Power system stability is divided into three if based on the magnitude of the disturbance. There

are steady-state, transient and dynamic stabilities.[1]

### Synchronous Machine Modeling

Power system modeling on this journal using linear modeling. linear modeling is used to observe the system response if given the small disturbance. The changes due to small disturbances suddenly can cause frequency changing and oscillation. Generally, generation system can be described as shown in Figure 2.1.

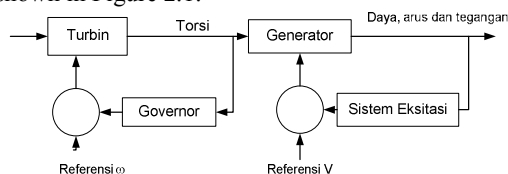


Figure 2.1 The block diagram of Single machine system

### Pemodelan Sistem Tenaga Listrik Mesin Tunggal

Single Machine Infinite Bus (SMIB) is a system that transmits the engine power to infinite bus [2]. Said to be infinite due to the distance between the engine and the load is considered very far through the transmission line with variable bond is not strong, so the voltage at the infinite bus can be assumed as the price is not disturbed [2].

Figure 2.2 show the sample of block diagram SMIB. In this system a generator represented by a single machine (single machine) to represent a power plant consisting of several generators [8]. The generator is connected through a transformer with multiple channels. Transmission channels that are connected to a bus with a fixed voltage source. Magnitude frequency and phase voltages are assumed not to change with changes in load [8].



Figure 2.2 Simplicity Diagram of SMIB

### C.1 Hadi Saadat's SMIB Model

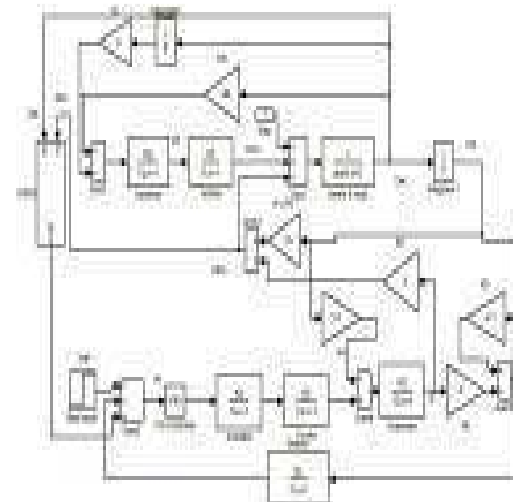


Figure 2.3 Diagram block of Hadi Saadat's SMIB Model

### C.2 Turbine and Governor System Modeling

Steam turbine has an input of mechanical energy which is sprayed from the boiler and mechanic output energy (torque) that used to drive a steam turbine. Model of a steam turbine governing system is IEEE model type 1 [4] in Figure 2.4:

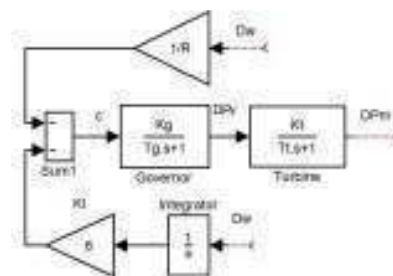


Figure 2.4 Diagram block of water turbine and governor system

The diagram block in figure of 2.4 obtained valve steam position and mechanical power equations as follows:

$$\Delta \dot{P}_v = -\frac{K_g \cdot K_i}{T_g} \cdot \Delta \delta - \frac{K_g}{T_g R} \Delta \omega - \frac{1}{T_g} \Delta P_v \quad (2.1)$$

$$\Delta \dot{P}_m = \frac{K_t}{T_t} \Delta P_v - \frac{1}{T_t} \Delta P_m \quad (2.2)$$

### C.3 Excitation System Modeling

The excitation system consists of a circuit of field and voltage regulator is Automatic Voltage Regulator (AVR). In this section, the excitation

system model that used refers to the IEEE model type 1 as shown in Figure 2.5 below:

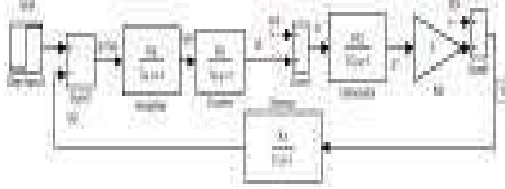


Figure 2.5 Diagram block of excitation system

From the block diagram in Figure 2.5, is obtained reinforcement voltage equation, excitation voltage, field promoted voltage and error voltage is as follows:

$$\dot{V}_R = \frac{K_A}{T_a} \cdot V_{ref} - \frac{K_A}{T_a} \cdot V_e - \frac{1}{T_a} V_R \quad (2.3)$$

$$\dot{V}_f = \frac{K_e}{T_e} \cdot V_R - \frac{1}{T_e} \cdot V_f \quad (2.4)$$

$$\dot{E} = -\frac{K_g \cdot K_4}{T_g} \cdot \Delta\delta + \frac{K_g}{T_g} V_f - \frac{1}{T_g} \dot{E} \quad (2.5)$$

$$\dot{V}_e = \frac{K_5}{T_R} \cdot \Delta\delta + \frac{K_6}{T_R} \cdot \dot{E} - \frac{1}{T_R} \cdot V_e \quad (2.6)$$

### C.7 Electromechanic Modeling

Phasor Diagram of rotor angle changing on synchronous machine modeling can be seen in Figure 2.9

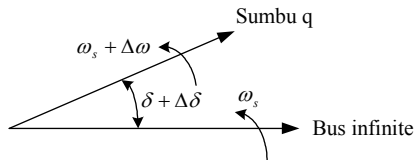


Figure 2.6 Phasor diagram of rotor angle changing

With,

$\Delta\delta$  : Rotor position changing.

$\Delta\omega$  : Rotor speed changing.

The following state space equation SMIB Hadi Saadat Model:

$$\dot{x} = Ax + Bu + LU \rightarrow \text{Input} \quad (2.10)$$

$$\begin{bmatrix} \Delta\dot{P}_v \\ \Delta\dot{P}_m \\ \Delta\dot{\delta} \\ \dot{V}_R \\ \dot{V}_f \\ \dot{E} \\ \dot{V}_e \\ \Delta\dot{\omega} \end{bmatrix} = \begin{bmatrix} -\frac{1}{T_g} & 0 & -\frac{K_g K_i}{T_g} & 0 & 0 & 0 & 0 & -\frac{K_g}{T_g R} \\ \frac{K_i}{T_i} & -\frac{1}{T_i} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{T_a} & 0 & 0 & -\frac{K_A}{T_a} & 1 \\ 0 & 0 & 0 & \frac{K_e}{T_e} & -\frac{1}{T_e} & -\frac{1}{T_g} & 0 & 0 \\ 0 & 0 & -\frac{K_g K_4}{T_g} & \frac{K_g}{T_g} & \frac{K_6}{T_g} & 0 & 0 & 0 \\ 0 & 0 & \frac{K_5}{T_R} & 0 & 0 & \frac{K_6}{T_R} & -\frac{1}{T_R} & 0 \\ 0 & \frac{1}{2H} & -\frac{K_3}{2H} & 0 & -\frac{K_2}{2H} & 0 & 0 & -\frac{D}{2H} \end{bmatrix} \begin{bmatrix} \Delta P_v \\ \Delta P_m \\ \Delta\delta \\ V_R \\ V_f \\ E \\ V_e \\ \Delta\omega \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ -\frac{1}{2H} \end{bmatrix} \begin{bmatrix} \Delta P_{L1} \\ V_{ref} \end{bmatrix}$$

$\omega_s$  : Synchronous velocity.

From the phasor diagram can be derived the following basic equation:

$$\frac{d\Delta\delta}{dt} = \omega_s \Delta\omega \quad (2.7)$$

The machine torque equation, namely mechanic torque and electric torque can be derived as follows:

$$T_m - T_e = J \frac{d\omega}{dt} + d\omega$$

Then obtained :

$$\Delta\delta = \frac{2\pi f}{s} \Delta\omega$$

$$\Delta T_m - \Delta T_e = (sM + D)\Delta\omega$$

As in Figure 2.7, point the block diagram from electro-mechanic equation of SMIB :

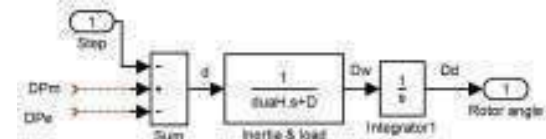


Figure 2.7 The block diagram of electro-mechanic

From the block diagram, is obtained equation as follows:

$$\Delta\delta = \frac{1}{s} \Delta\omega$$

$$\Delta\dot{\delta} = \Delta\omega \quad (2.8)$$

Furthermore obtained :

$$\Delta\dot{\omega} = \frac{-1}{2H} \cdot \Delta P_{L1} + \frac{1}{2H} \cdot \Delta P_m - \frac{K_3}{2H} \cdot \Delta\delta - \frac{K_2}{2H} \cdot \dot{E} - \frac{D}{2H} \cdot \Delta\omega \quad (2.9)$$

Then  $y=cx$   $y \rightarrow$  Output

$$[V_t] = [0 \ 0 \ K_5 \ 0 \ 0 \ K_6 \ 0 \ 0] \begin{bmatrix} \Delta P_v \\ \Delta P_m \\ \Delta \delta \\ V_R \\ V_f \\ \dot{E} \\ V_e \\ \Delta \omega \end{bmatrix} \quad (2.11)$$

### Dual Input Power System Stabilizer (DIPSS)

Dual Input Power System Stabilizer (DIPSS) is a type of PSS which can reduce signal noise [5,6]. This noise signal will result in the bad reference input to the system. This noise signal can be sourced from motion shaft such as shaft lateral runout which causes excessive modulation on the excitation system of generator or can also come from torsional oscillations that caused by changes in the electrical torque.

The input of stabilizer such as changes the rotor angular velocity ( $\Delta \omega$ ) and changes the electrical power ( $\Delta P_e$ ). This model is taken from IEEE PSS2B type. The complete modeling of DIPSS showed in Figure 2.11.

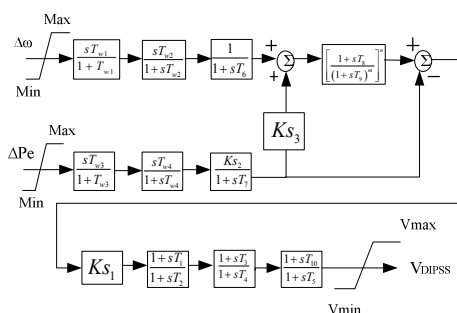


Figure 2.8. The block diagram of Dual Input Power System Stabilizer (IEEE type PSS2B)

### Firefly Algorithm (FA)

#### E.1 Behavior of Fireflies

The Firefly Algorithm (FA) is an algorithm metaheuristic-inspired from the behavior of fireflies blinking. The resulting light is bioluminescence process. There are two fundamental functions of the light, the first to attract the attention of other fireflies (communication) and to survive predator attacks.

Dr Xin-She Yang develops FA based from habits of Firefly to attract mating partners (communication). In formulating FA, Dr Xin - She Yang assumes some rules as follows :

1. All fireflies are unisex so that one firefly will be attracted to other fireflies regardless of their sex.

2. Attractiveness is proportional to the their brightness, thus for any two flashing fireflies, the less brighter one will move towards the brighter one. The attractiveness is proportional to the brightness and will be decrease as their distance increases.
3. The brightness of firefly is affected by the landscape of the objective function. If there is no brighter one than others, firefly will move randomly.[7].

#### E.2 The Light Intensity and Attractiveness

The light intensity  $I(r)$  varies according to the inverse square law.

$$I(r) = \frac{I_s}{r^2}, \quad (2.12)$$

Where  $I_s$  is the intensity at the source. For a given medium with a fixed light absorption coefficient  $\gamma$ , the light intensity  $I$  varies with the distance  $r$ . That is

$$I = I_0 e^{-\gamma r} \quad (2.13)$$

Where  $I_0$  is the original light intensity. In order to avoid the singularity at  $r = 0$  in the expression  $I_s/r^2$ , the combined effect of both the inverse square law and absorption can be approximated as the following Gaussian form

$$I(r) = I_0 e^{-\gamma r} \quad (2.14)$$

For a firefly's attractiveness is same to the light intensity seen by adjacent fireflies, we can now define the attractiveness  $\beta$  of firefly according distance  $r$  by

$$\beta(r) = \beta_0 e^{-\gamma r^m} \quad (2.15)$$

Where  $\beta_0$  is the attractiveness at  $r = 0$ . Conversely, for a given length scale  $\Gamma$  in an optimization problem, the parameter  $\gamma$  can be used as a typical initial value. That is

$$\gamma = \frac{1}{\Gamma^m} \quad (2.16)$$

The distance between any two fireflies  $i$  and  $j$  at  $x_i$  and  $x_j$ , respectively, is the Cartesian distance [7]:

$$r_{ij} \|x_i - x_j\| = \sqrt{\sum_{k=1}^d (x_{i,k} - x_{j,k})^2}, \quad (2.17)$$

The movement of a firefly  $i$  is attracted to another more attractive (brighter) firefly  $j$  is determined by

$$x_i = x_i + \beta_0 e^{-\gamma r_{ij}^2} (x_j - x_i) + \alpha \epsilon_i, \quad (2.18)$$

Information :

$x_i$  : Spatial Coordination firefly to- $i$

$x_j$  : Spatial Coordination firefly to- $j$

$\alpha$  : Randomization parameter

$\epsilon_i$  : Vector of random number between [0-1]

### 3. OPTIMIZATION OF PID AND DIPSS USING FIREFLY ALGORITHM

#### Data of SMIB System

The model of system can be seen in figure 2.3. the parameter of system as shown in table 3.1.

Table 3.1. Parameter Data of SMIB

No.		Gain	Time Constant
1	Turbine	$K_t=1$	$T_t=0.5$
2	Governor	$K_g=1$	$T_g=0.2$
3	Amplifier	$K_a=10$	$T_a=0.1$
4	Exciter	$K_e=1$	$T_e=0.4$
5	Generator	$K_G=0.8$	$T_G=1.4$
6	Sensor	$K_r=1$	$T_r=0.05$
7	Inertia	$H=5$	
8	Regulation	$R=0.05$	

On simulation, the load varies by 0.8 percent ( $D = 0.8$ ) for a 1 percent change in frequency. Assume the synchronizing coefficient  $P_s$  or  $K_3$  is 1.5, and the voltage coefficient  $K_6$  is 0.5. While the coupling constant are  $K_2 = 0.2$ ,  $K_4 = 1.4$ , and  $K_5 = 0.1$ . Simulation of block diagram worked on SIMULINK MATLAB. The results of simulation, there are speed deviation of rotor ( $\Delta\omega$ ), rotor angle changes ( $\Delta\delta$ ) and change of voltage terminal ( $V_t$ ).

#### Added PID and DIPSS Controller

System with PID and DIPSS Controller can be seen in figure 3.1.

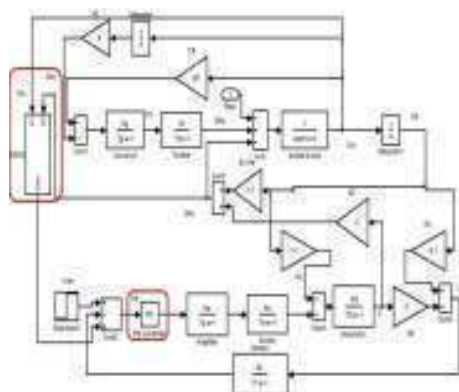


Figure 3.1. Diagram block of SMIB with PID and DIPSS Controller

After DIPSS installed on the system, the system response of SMIB observed. The responses which is observed, such as change of speed ( $\Delta\delta$ ), change angle of rotor ( $\Delta\delta$ ) and voltage terminal ( $V_t$ ).

#### Coordination of PID and DIPSS Controller Using FA

FA tunes parameter of PID and DIPSS Controller. The parameter of PID consist of  $K_p$ ,  $K_i$  and  $K_d$ , while parameter of DIPSS consist of parameter wash out ( $T\omega_1, T\omega_2, T\omega_3$  and  $T\omega_4$ ), time constant ( $T_1, T_2, T_3, T_4, T_5, T_6, T_7, T_8, T_9$  and  $T_{10}$ ) and gain ( $K_{s1}$ ,  $K_{s2}$  and  $K_{s3}$ ). So there are 20 parameter that would optimized.

*Firefly algorithm* loads  $n$  (individual) *firefly*, each *firefly* have the value of 20 parameter that would tuned. The parameter constant that used into this optimization method as shown in table 3.2. Flowchart about procedure of computation from followed method to find the value of PID and DIPSS parameter using FA can be seen in figure 3.2.

Table 3.2. The parameter of FA

Amount of Firefly (n)	Iteration amount	Alpha	Betamin	Gamma
30	5000	0,35	0,2	1

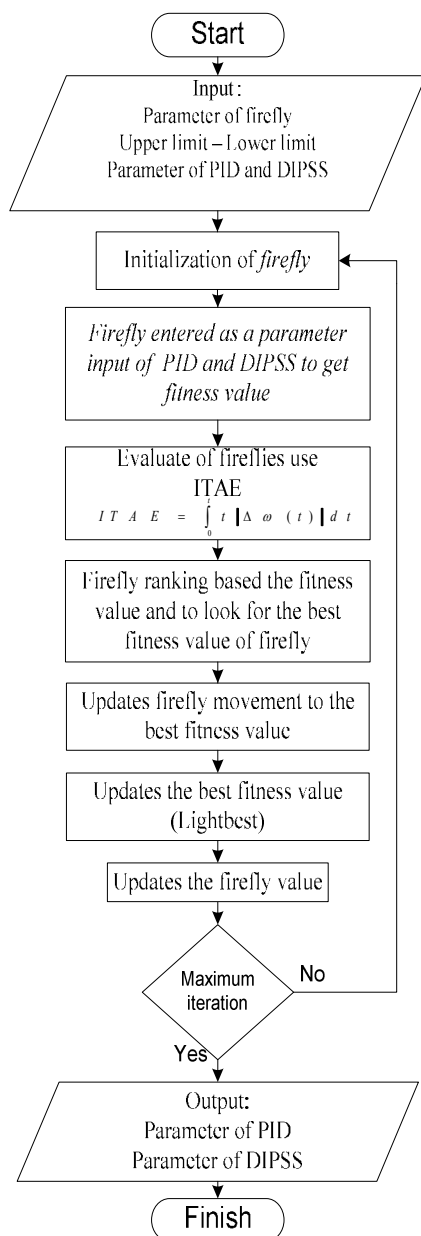


Figure 3.2. Flowchart search-parameters using FA

The results of the tuning is then analyzed to get good responses. In this research, the objective function is used to test the stability of the system is the Integral Time Absolute Error (ITAE).

$$ITAE = \int_0^t t |\Delta\omega(t)| dt \quad (3.1)$$

#### 4. SIMULATION AND ANALYSIS

In the simulation system, given a dynamic disturbance such as change of load around 0.01pu.

##### A. Change Frequency Response

Figure 4.1 is graph of electrical frequency response ( $\Delta f$ ) on the system. Comparison of overshoot and settling time of the electrical frequency response in the systems can be seen in Table 4.1.

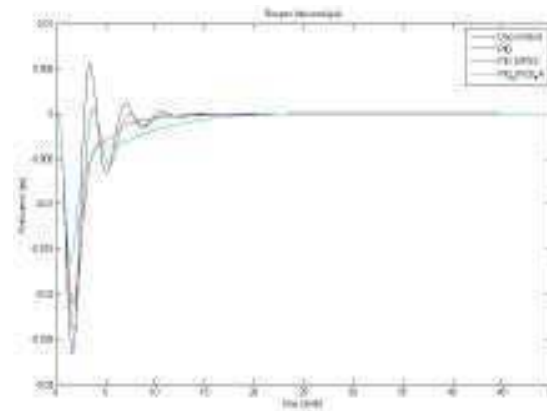


Figure 4.1. Electrical frequency response of the system changes ( $\Delta\omega$ ) with a 0.01 pu load change

Table 4.1. Data of Changes in electrical frequency response ( $\Delta\omega$ ) in the systems with a 0.01 pu load change

Control method	Overshoot (pu)	Settling time (s)
Uncontrolled	-0,027	14
PID Conv	-0,0245	15
PID DIPSS Conv	-0,021	16
PID DIPSS FA	-0,0165	20

##### B. Response of Rotor Angle Changes

Figure 4.2 is graph of rotor angle response ( $\Delta\delta$ ) on the system. Comparison of overshoot and settling time of the rotor angle response in the systems can be seen in Table 4.2.



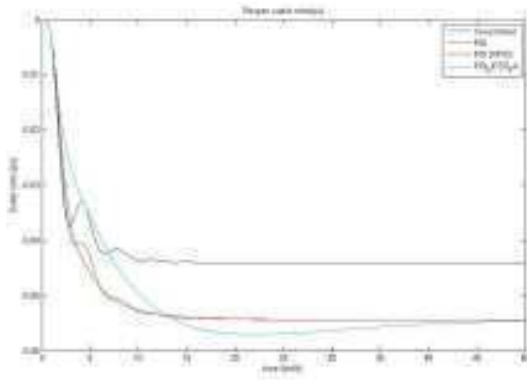


Figure 4.2. Response of rotor angle changes( $\Delta\delta$ ) with load change 0.01 pu

Table 4.2. Data of rotor angle change response ( $\Delta\delta$ ) with load change 0.01 pu

Control method	Overshoot (pu)	Settling time (s)
Uncontrolled	-0,037	17
PID Conv	-0,05	24
PID DIPSS	-0,041	25
Conv		
PID DIPSS FA	-0,025	48

### C. Response of Terminal Voltage Changes

Figure 4.3 is graph of terminal voltage response ( $V_t$ ) on the system. Comparison of overshoot and settling time of the terminal voltage response in the systems can be seen in Table 4.3.

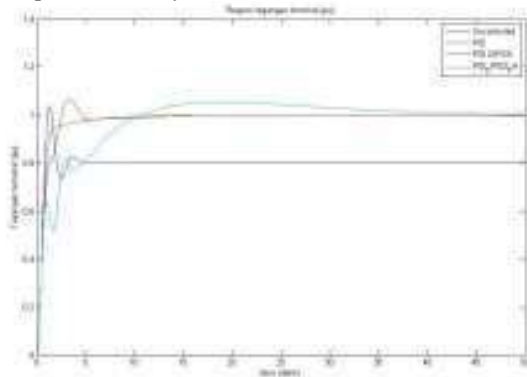


Figure 4.3 Response of terminal voltage ( $V_t$ ) with load change 0.01 pu

Table 4.3. Data of terminal voltage response ( $V_t$ ) with load change 0.01 pu

Control method	Overshoot (pu)	Settling time (s)
Uncontrolled	1,02	10
PID Conv	0,96	15
PID DIPSS	0,8	16
Conv		
PID DIPSS FA	0,6	48

From the simulation results, it can be seen that system that use PID controller and DIPSS have a better overshoot response. The other side, it has a longer settling time in response to change in electrical frequency ( $\Delta f$ ), but it is meaningless. This show that by adding DIPSS can reduce overshoot of the electrical frequency deviation on the system. However when using PID controller and DIPSS are optimized with FA, the system has the best response of overshoot. This indicates that by using FA obtained the optimal coordination of PID and DIPSS parameter, so it able to dampen the oscillation of system better than controller another.

### 5. CONCLUSION

Coordination of PID controller and DIPSS can be implemented on SMIB to improve response of system against small disturbance. Application of optimization method FA can be optimizes the parameter value of PID controller and DIPSS. It can be seen when the system is given increased load 1% of system capacity, when using PID-DIPSS-FA obtained the overshoot value that is equal to -0.0165 pu and -0.021 pu when using PID-DIPSS without tuning. Likewise for other value increased load of system capacity, the system response is proportional to disturbance. For a longer setting time of PID-DIPSS-FA compared PID-DIPSS without tuning it wasn't significantly.

### References

- [1] Milles, R.H., Malinowski, J.H., "Power System Operation", Mc GrawHill, Singapore, Ch.12, 1994.
- [2] Robandi, Imam. "Modern Power System Control", Penerbit ANDI, Yogyakarta. 2009.
- [3] Soeprijanto, Adi. "Desain KONTROLLER untuk Kestabilan Dinamik Sistem Tenaga Listrik", Itspress, Surabaya. 2012.
- [4] P.M. Anderson & A.A. Fouad, Power system control and stability, The Iowa State University Press, 1977.
- [5] Saadat H., "Power Sistem Analysis", Second Edition, McGraw-Hill International Edition, Singapore, 2004.

- [6] Handbook of Mitsubishi Electric Power System Stabilizer.
- [7] Yang Xin-She, "Engineering Optimization", A Jhon Wiley & Sons, New Jersey, 2010.
- [8] K.K Wendy, Z.A.M. Benie, As'adi, A.Musyafa, and R. Imam. "Optimization

of Capacitive Energy Storage (CES) for Improved Transient Stability on Single Machine Infinite Bus (SMIB) using Differential Evolution Algorithm" presented at APTECS, Surabaya, Indonesia, 2010.

## PERFORMANCE ANALYSIS OF TIME DIVISION MULTIPLEXING (TDM) FOR ANALOG SIGNAL THROUGH OPTICAL FIBER AND CONDUCTOR TRANSMISSION

**Sholeh Hadi Pramono, Sapriesty Nainy Sari, and M. Fauzan Edy Purnomo**  
Department of Electrical Engineering, Faculty of Engineering, Brawijaya University  
Jl. MT. Haryono 167 Malang 65145, Ph./Fax: 0341-554166  
Email: sholehpramono@ub.ac.id, nainy\_sari@ub.ac.id, mfauzane@ub.ac.id

### **Abstract**

*There is an increasing demand for high data-rate communication in the costumer's premises to provide communication services. A wide variety of techniques for signal transmission with advanced technology has been widely applied to improve the quality of service for users. As with the use of optical fiber as a data transmission medium capable of providing network capacity than conductor cable. Optical communication systems are currently widely applied to TDM-based transmission systems are each separated by a time domain channel. Data transmission is done by mixing the data based on time. Signals are transmitted and used for the transmission of digital signals. Data is transmitted through an optical fiber and conductor. Source analog signal derived from the signal generator at a frequency of 250Hz, 500Hz, 1kHz, and 2kHz. Contributions noise that occurs in the signal transmission of information sent through an optical fiber is higher than that transmitted through the cable conductor. Delay time for the highest value of the information signal with the lower frequency is equal to 0.57ms and 0.54ms for the conductor to the fiber optic cable.*

**Keywords:** time domain, frequency, noise, delay time

### **INTRODUCTION**

The need for communication services with high quality and greater network capacity becomes a very important issue. A wide variety of techniques for signal transmission with advanced technology has been widely applied to communications both analog and digital in order to improve the quality of service for users. As with the use of optical fiber as a data transmission medium capable of providing network capacity than conductor cable.

In addition, it should be noted also increased efficiency in the use of communication devices. Multiplexing is a technology that allows multiple

resources to share the same transmission channel so that the use of communication devices can be maximized. One of the multiplexing technique that is often used today is Time Division Multiplexing (TDM) that transmits some information on a specific time period. The sources of transmission utilizing slices (or slots) time or in other words alternately occupy the transmission medium [1].

Previously been discussed about Angular Mode Group Diversity Multiplexing individual transmission channels with a higher bandwidth can be created in step index Plastic Optical Fibres using low cost non-wavelength specific optical components. These channels can be used for high capacity universal in-home multimedia networks [2].

Optical communication systems are currently widely applied to TDM-based transmission systems are each separated by a time domain channel. Technically, the transmission system only uses one wavelength for all channel information, which is called the single-wavelength transmission systems. TDM is also able to be applied for the communication system that uses electrically conductive cable transmission media. In both systems, between optical communication systems and electrical communications cable will get different TDM performance, so it will be compared to the performance of the two systems.

### **TIME DIVISION MULTIPLEXING**

Multiplexing is a transmission technique that sends more than one information through one channel. The main purpose of multiplexing to save on the number of physical channels such as cable, transmitter and receiver (transceiver), or optical cables. Examples of the application of multiplexing techniques is the long distance transmission networks, both wired and who uses the medium of air (wireless or radio).

TDM is merging technique (multiplexing) several channels of information (low rate) to the transmission channel (high speed) with the division

of time or based on the time domain. In this multiplexing technique, information of each channel will be sampled and sent in the transmission channel alternately and sequentially continuous. TDM is the most common technique used weeks to transmit digital signals at a low rate channel high speed transmission facility. Multiplexing function is performed by allocating

each channel into time slots information on the transmission channel high speed. Combined multiple time slots containing information and other signals taken at a particular period will form the frame. In the formation of this frame framing pattern periodically added to the facility to identify the position of high speed low-speed channels in the receiver.

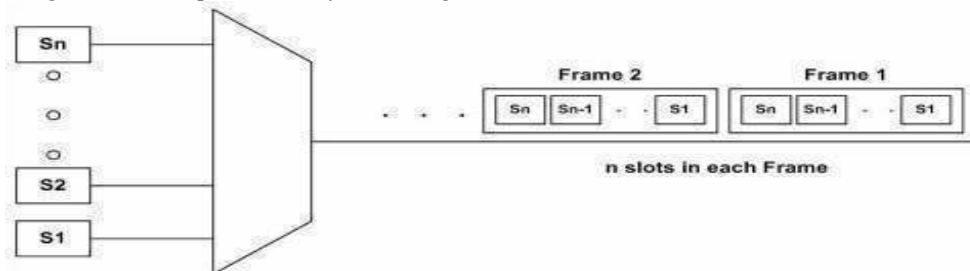


Fig. 1. Time Division Multiplexing Process [3]

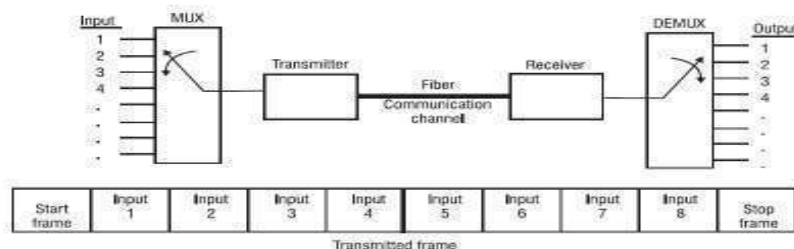


Fig. 2. Time Division Multiplexing Process over Fiber Optic

Operation of TDM is shown in Figure 1, where the composite signal has a blank space between the sample pulses, which are used to prevent interchannel cross talk. Along with the sample pulse, a pulse is sent in every cycle synchronization which in turn will form a frame along with the information. Each frame containing time slots within each frame cycle, one or more slots are used for each data source. Maximum bandwidth (data rate) of a TDM system is at least equal to the rate of data resources.

In STDM system, each transmission source can access to the media during a certain period, in which each time slice is the same size. Each terminal get one chance to transmit data, and after that the terminal in question can't transmit the data to all other terminals have gained each turn [1].

The purpose of multiplexing is to share a single transmission channel bandwidth for multiple users. Two methods are commonly used in multiplexed optical fiber:

1. Time Division Multiplexing (TDM)
2. Wavelength Division Multiplexing (WDM)

Fiber optics is a transmission line made of glass or plastic that is used to transmit light signals

from one place to another. Optical fiber communication systems utilizing light as an information carrier wave to be transmitted. In the signaling sender information is converted into optical cues. Then forwarded to the channel information is also made of the optical fiber serving as waveguides. Arriving at the receiver beam of light captured by the light detector, which serves to change the amount of optical into electrical magnitude. Here the light experiencing widening and weakening, caused by impure fiber materials, which absorb and scatter light.

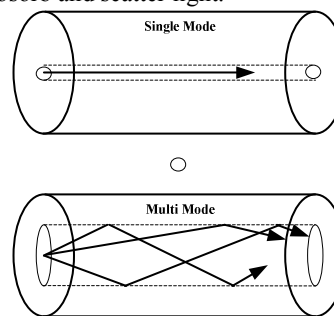


Fig. 3. Basic Types of Fiber Single Mode and Multi Mode [4]

Based on the trajectory of the light, the optical fiber can be divided into two, single mode and multi mode as shown in Figure 3. In single mode, the core diameter is much smaller than the diameter of the cladding is 8-12 micrometers to 125 micrometers for the core and the cladding. Very small core diameter is causing the light propagates in a straight line in the core, so that there is only one light path. While the multi-mode, the core diameter of 50-200 micrometers and a cladding diameter of 125-400 micrometers. Core diameter is large enough to be more than one cause streaks of

light in the core. Because there is only one light path, the single mode optical fiber will result in higher transmission speeds than multi-mode optical fiber. In addition, single mode optical fiber will also have a smaller attenuation than multi-mode optical fiber.

## METHODOLOGY

### 1. Designing and Modeling System

The design of TDM and demultiplexing analog signal through an optical fiber can be seen in Figure 4.

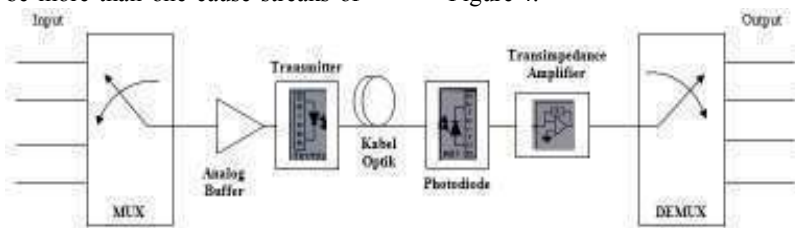


Fig. 4. Block Diagram of the Analog Signal Measurement TDM with Fiber Optic Cable



Fig. 5. Block Diagram of the Analog Signal Measurement TDM with Conductor Cable

Data transmission is done by mixing the data based on time. Signals are transmitted and used for the transmission of digital signals. Data is transmitted through an optical fiber in the form of pulses of light or rays, so that this data can't be intercepted. Before the electric light transmitted through this medium, must first be converted into a signal in the form of light. After the light signal is received, then the receiver will convert back into an electrical signal.

### 2. Experimental

The data were obtained through the testing process for the set-up is shown in Figure 6. Source analog signal derived from the signal generator at a frequency of 250 Hz, 500 Hz, 1 kHz, and 2 kHz. The analog signal is put together into a multiplexer circuit alternately transmitted by time and is known as time division multiplexing.

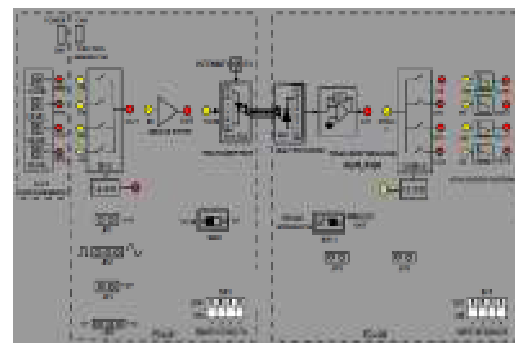


Fig. 6. Experimental Process TDM Through Fiber Optic and Conductor

Data obtained from the test results is the level of data that is sent and the signal amplitude received, form the output signal of the multiplexer circuit, the output signal shape after a run through the analog buffers, and the shape of the output signal before and after the demultiplexer through the filter.

## RESULT AND DISCUSSION

The output signal measured at the demultiplex circuit showed defects caused by noise signal. This noise occurs because the signal is passed on some

electronic circuits, the multiplexer circuit, a buffer circuit, a series of optical transmitter, optical receiver circuit, the circuit transimpedance amplifier, and a demultiplex circuit. Noise contribution given by each circuit is caused by thermal noise and random fluctuations of an electron in electronic components. The higher frequency of the transmitted information signal multiplexing and demultiplexing through shows signal level greater disability. Frequency information which will contribute to the higher thermal and random fluctuations are higher. Disability signals that occur in the optical transmission greater than the disability signal transmission through the conductor. This happens because the transmission of information through an optical pass many electronic circuits compared to the conductor passes. The transmission of information via the cable conductor is not passed in the buffer circuit, a series of optical transmitters, optical receiver circuit, and a transimpedance circuit.

Comparison of the amplitude level of the input signal and the output signal for transmission on the wire conductor is shown in Figure 7. As for optical fiber transmission is shown in Figure 8. Based on the obtained graph that can be analyzed for analog signal transmission through optical fibers with TDM levels decreased by 50%.

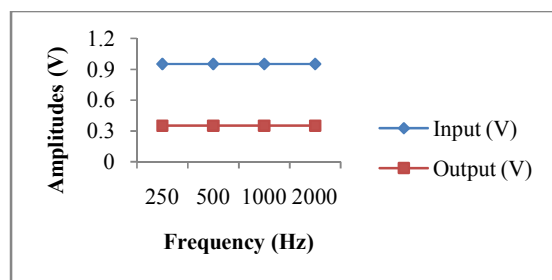


Fig. 7. The Comparison of Amplitudes Input to Output Signal Through Fiber Optic

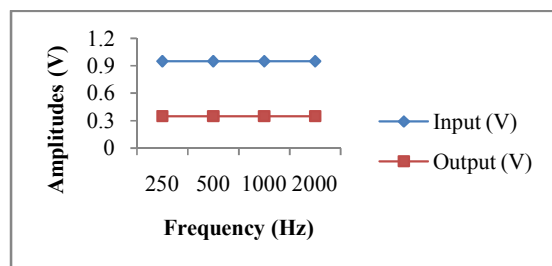


Fig. 8. The Comparison of Amplitudes Input to Output Signal Through Fiber Optic

Disability information signal coming out of the demultiplex circuit can be improved by passing the signal information into the filter. Suitability forms multiplexer input signal with an output signal demultiplexer (after passed the filter) show that this filter has excellent function to eliminate noise that occurs. Filters used in this experiment is the 4th order filter, this filter means having a sharper slope. The sharpness of the slope at 40 dB / decade compared with the first-order filters are only 10 dB / decade.

Another aspect that can be analyzed in a multiplexed system are aspects of damping and delay time. Attenuation in the optical fiber showed a higher value, it is due to the coupling loss between the transmitter (Light Emitting Diode) and fiber, and the fiber with the receiver (photo diode). The coupling loss can reduce power by up to 50% of the input signal. Copper impact small losses in the transmitted signal due to only 1 m long copper and a low frequency of the transmitted signal is 250 Hz to 2 KHz. Low-frequency skin effect impact low, meaning that the signal can pass through the entire information of the conductor material. Delay time showed almost the same value for both the transmission medium. The higher the frequency of the transmitted signal is the lower value of the delay time as shown in Figure 9. Large delay time for frequency 250 Hz transmission over conductor is 0.57 ms, whereas for optical fiber of 0.54 ms. The smallest value of delay time when the highest frequency of 2 kHz is equal to 0.17 ms for transmission over conductor and 0.16 ms for transmission over optical fiber.

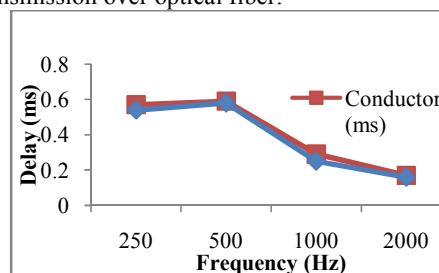


Fig. 9. Delay Comparison of Conductor and Fiber Optic Transmission

## CONCLUSION

Based on the experimental result can be concluded:

1. Buffer amplifiers have a role in maintaining the amplitude of the output signal level multiplexed before being transmitted into optical.

2. Synchronization needs to be done to get the appropriate output signal after leaving the demultiplexing process.
3. Contributions noise that occurs in the signal transmission of information sent through an optical fiber is higher than that transmitted through the cable conductor.
4. 4th order filter is able to remove noise that exist in the information signal after leaving the demultiplexing process.
5. Information signal attenuation that occurs in optical fibers is higher than that occurring in the cable conductor.
6. Delay time for the highest value of the information signal with the lower frequency is equal to 0.57 ms and 0.54 ms for the conductor to the fiber optic cable.

#### References

- Tittel, Ed, "Schaum's Outline: Computer Networking", Penerbit Erlangga, 2004.
- H.P.A. van den Boom, A.M.J. Koonen, F.M. Huijskens, and W. van Gils, *Angular Mode Group Diversity Multiplexing for Multi-channel Communication in a Single Step-Index Plastic Optical Fibre*. Proceeding Symposium IEEE/LEOS Benelux Chapter, 2005, Mons.
- Putra, Surawan Adi, dkk, "Transmisi Data Menggunakan Teknologi *Dense Wavelength Division Multiplexing* (DWDM)", e-Indonesia Initiative 2009 (eII2009), Konferensi dan Temu Nasional Teknologi Informasi dan Komunikasi untuk Indonesia, 24 - 25 Juni 2009, Bandung.
- Pratiwi, Sari Eka, "Sistem Komunikasi Serat Optik di PT. Telkom Indonesia, Tbk. Bandung", Laporan Kerja Praktek Jurusan Teknik Elektro ITS, 2008.
- Keiser, Gerd, *Optical fiber communications*. Singapore: McGraw-Hill, 2000.
- Chinlon Lin, *Broadband optical access networks and fiber-to-the home: systems technologies and deployment strategies*. England: John Wiley & Sons Ltd, 2006.
- Bass, Michael., Stryland, Eric W. Van, *Fiber optics handbook: fiber, devices, and system for optical communication*. New York: McGraw-Hill, 2002.
- Lam, Cedric F., *Passive optical networks: principles and practice*. USA: Academic Press publications, 2007.

## ORGANIC SOLAR CELL BASED ON EXTRACTION OF PAPAYA (*Carica papaya*) AND JATROPHA (*Ricinus communis*) LEAVES IN DSSC (DYE SENSITIZED SOLAR CELL)

Sholeh Hadi Pramono, Eka Maulana, M. Julius St., and Teguh Utomo

Department of Electrical Engineering, Brawijaya University  
sholehpramono@ub.ac.id, sholehpramono@gmail.com, ekamaulana@ub.ac.id

### Abstract

*This article shows an experimental result of DSSCs (Dye Sensitized Solar Cell) fabrication and characterization of based on papaya (*Carica papaya* L.) leaves and jatropa (*Ricinus communis*) leaves. Chlorophyll was extracted from the both leaves as organic dye materials to replace previous solar cells based on inorganic materials such as silicon. A TCO (Transparent Conductor Oxide) was used as a substrate material that surrounds the inner layer of DSSC. TiO<sub>2</sub> nano particles, natural dyes, electrolytes, and counter electrode combined as an donor-acceptor layer. Thick film screen printing method is used for the adhesion of the TiO<sub>2</sub> layer to the substrate. Couples of iodine and tri-iodine electrolyte solution used as an electron donor layer. We designed the active area cell size of 1.8 x 1.8 cm on two layers of TCO glass substrate. The wavelength absorption measurements of extracted chlorophyll occurs in the spectrum of 300-700nm. We measured open circuit voltages (Voc) under light illuminance of 18,000 lux are 289 and 245 mV of papaya and jatropa leaves, respectively. A Sort circuit current was achieved at -17 and -6.7  $\mu$ A. These cells have already reached fill factors (FF) exceeding 26% and 25%.*

**Keywords:** DSSC, chlorophyll, organic, papaya, jatropa leaves

### BACKGROUND

DSSC (Dye Sensitized Solar Cells) have been developed to improve performance and new material solar cell since photoelectrochemical reaction was found by Gratzel [1]. This phenomenon gives a significant impact on the system of conventional-based solar cells. Development of organic solar cells has been offering cost-efficiency of production, flexible substrates, and low-cost materials [2]. In recent years, a lot of research have been done to obtain organic material substitute inorganic materials are low-cost and high efficiency from 1 to 11% [3-5]. Photosynthesis process convert light energy into

chemical energy in plants is a fundamental biomimetic approach to the process of converting light energy into electrical energy in DSSC. The role of chlorophyll at leaves is to harvest the light at a certain wavelength spectrum of sunlight. The efficiencies of the DSSC up to 11% have been designed using ruthenium (Ru) based dye but limited availability and high cost [6]. Some methods have been developed to assemble the DSSC, including screen printing, simple brush printing, doctor-bladding, and spin-coating [7,8]. In this paper will be presented the result of the research combination of organic and inorganic material based on DSSC. Organic dye materials are used in the extraction are papaya and jatropa leaves that estimated has high levels of chlorophyll thus expected to absorb more photons.

### METHOD

#### Materials

A basis substrate was used in this research is conductive (indium tin dioxide coated) transparent glass (Aldrich corp, TCO-ITO) cut with area of 2x2cm and surface resistivity of 15-25 $\Omega$ /sq. TCO (Transparent Conductive Oxide) is a transparent conductive glass that function as the body of the solar cell and it conductive layer. This solar cell body serves as a charge flows. Nano powder TiO<sub>2</sub> (Aldrich corp., titanium dioxide) 21 nm particles size were used as photoactive layer material. Nanopori TiO<sub>2</sub> has a band gap energy of 3.2 eV is needed as transparent semiconductor in most solar light spectrum. In addition, the TiO<sub>2</sub> structure that the pore size in the nanoscale will increase the system performance because nanopori structure has the characteristics of high surface area so it will increase the amount of dye that adsorpted.

Electrolyte used in DSSC consists of iodine (I) and tri-iodide (I<sub>3</sub><sup>-</sup>) as redox couple in the solvent. The Electrolyte-making procedures performed as follows:

- preapring a solution of KI (Potassium Iodide) 0.5 M by dissolving 0.83 g in 1 ml of distilled water, then added 9 ml acetonitrile



- preparing solution of iodine (I<sub>2</sub>) 0.05 M by adding a solution of 0.126 g to (1)
  - Mixture solution of (1) and the solution (2) was stirred with a rotary motor for 15 minutes to homogenize the solution.
  - The solution was stored in sealed bottles
- Counter Electrode catalyst needed to accelerate the reaction kinetics of the reduction process triiodide on TCO. The material used as a catalyst is obtained from the combustion of carbon from wax attached to TCO.

Two materials were used in this research are papaya and jatropa leaves as organic natural dye. Those leaves was extracted by ethanol of 95% to produce their chlorophyll. The principle of extraction of chlorophyll from the leaves of papaya/jatropa performed by stages as follows:

- Papaya/jatropa leaves washed with distilled water, then dried.
- Papaya/jatropa leaves weighed 10 grams
- Papaya/jatropa leaves that had been crushed in a clean porcelain dish until smooth and put into 50 ml of 96% ethanol. Comparison of leaf: ethanol is 1:5. The function of ethanol as a solvent to dissolve the chlorophyll in the leaves of papaya/jatropa.
- Chlorophyll extract was stirred with a rotary motor for 30 minutes
- Extract chlorophyll put in dark bottles and left for 24 hours to maximize extraction process
- Chlorophyll extract was filtered with a filter paper, stored in a dark bottle that had been wrapped in aluminum foil and stored in the dark/fridge.

### Experimental Setup

We design the structure of DSSC was shown in Figure 1 and 2.

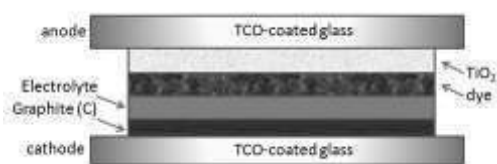


Fig. 1. Layer structure

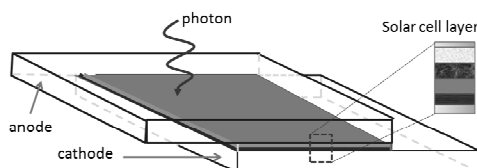


Fig. 2. Configuration of DSSC

Material layers are arranged from top to bottom in the order of substrate, TiO<sub>2</sub>, natural dye, electrolyte, carbon counter electrode, and TCO substrate, respectively. A screen printing was applied for fabrication method of TiO<sub>2</sub> deposition.

### Measurement and Data Analysis

Light absorbance measurement of the chlorophyll sample was used spectrophotometer. The wavelength was chosen for measurement of 200-800 nm. The experimental setup for measurement of the electricity of DSSC is shown in Figure 3. The light measured by lux meter (Lx) through the DSSC can be varied, so the output voltage and current varied too. The second method, value of the load resistance be varied to get electricity performance of DSSC.

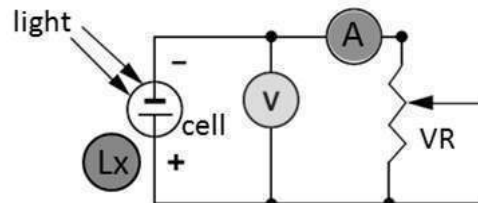


Fig. 3. Experimental setup of DSSC measurement

Some parameters were observed are open voltage circuit (V<sub>oc</sub>) and short circuit current (I<sub>sc</sub>), V<sub>max</sub>, and I<sub>max</sub> to obtain fill factor (FF) and efficiency (η). The FF is defined by the ratio of the maximum power output of DSSC device its theoretical power output if both current and voltage were at their maxima, I<sub>sc</sub> and V<sub>oc</sub>, respectively [9]. The calculation of fill factors is given as:

$$FF = \frac{I_{\max} \times V_{\max}}{I_{sc} \times V_{oc}} \quad (1)$$

### RESULT AND DISCUSSION

The result of chlorophyll extractions were measured by the spectrophotometer are shown in Figure 4.

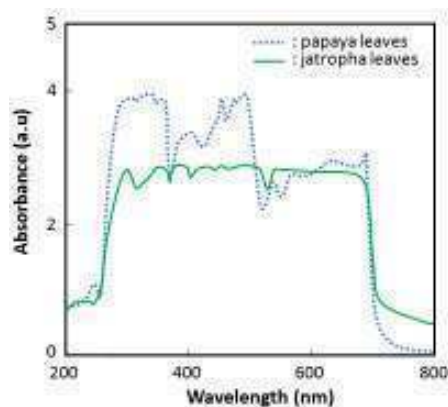


Fig. 4. Absorbance spectra of chlorophyll

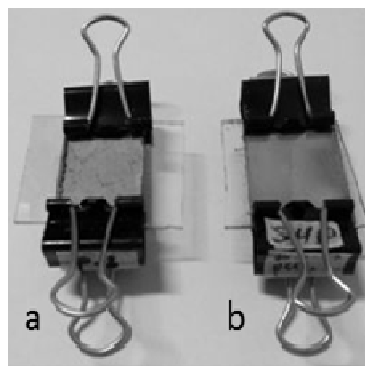


Fig. 5. Construction of DSSC  
(a). Papaya leaves. (b) Jatropa leaves

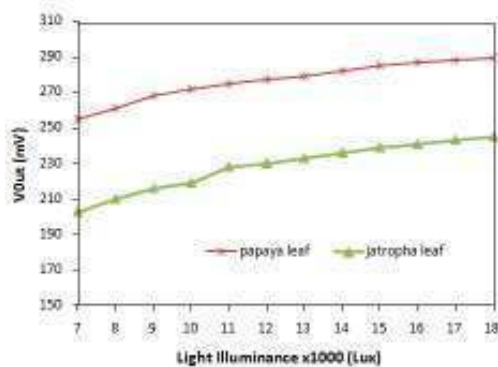


Fig. 6. Characteristic of Vout DSSC  
Papaya leaves (red), Jatropa leaves (green)

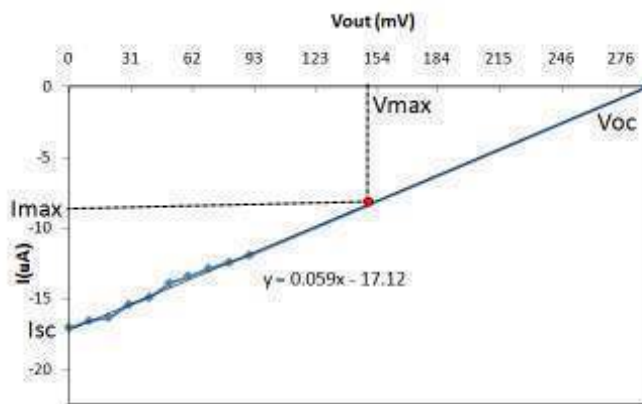


Fig. 7. Measurement Characteristic of Papaya leaves DSSC

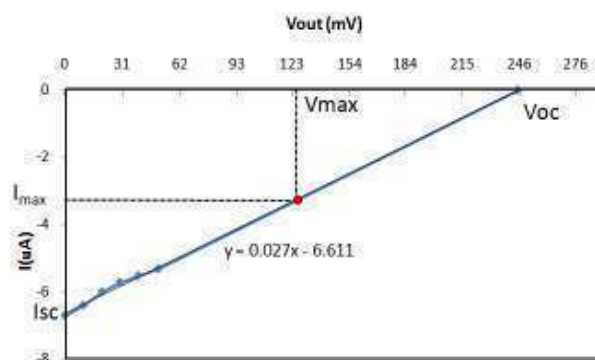


Fig. 8. Measurement Characteristic of Jatropha leaves DSSC

Figure 6 shows a correlation between the level of chlorophyll absorption against electrical power generated by the DSSC. The average value of the output voltage difference indicates the same value relative is 60.2 mV in the range of light intensity of 7000-18000 lux. The magnitude of the voltage generated by the two DSSC was comparable to the magnitude of the incident light radiation.

Electrical characteristic of DSSC shown in Figure 7 and 8. The maximum power point of papaya leaves chlorophyll was obtain at  $I_{max}$ , and  $V_{max}$ , are 8.586uA, and 146mV, respectively. In the other hand, the maximum power point of jatropha leaves was obtain at  $I_{max}$ , and  $V_{max}$ , are 3.317uA, and 122mV, respectively. Figure 7 and 8 show the characterization of the output voltage against current is increasing linearly. Comparison between two cells, the key of DSSC parameter have already reached fill factors (FF) up to 26% and 25%.

## CONCLUSION

According to the result of this experiment, we conclude that DSSCs (Dye Sensitized Solar Cell) have been fabricate based on papaya (*Carica papaya* L.) leaves and jatropha (*Ricinus communis*) leaves. Chlorophyll was extracted from the both leaves as organic dye materials. We designed the active area cell size of 1.8 x 1.8 cm on two layers of TCO glass substrate. The wavelength absorption measurements of extracted chlorophyll occurs in the spectrum of 300-700nm. We measured open circuit voltages ( $V_{oc}$ ) under light illuminance of 18,000 lux are 289 and 245 mV of papaya and jatropha leaves, respectively. A Sort circuit current was achieved at -17 and -6.7  $\mu$ A. These cells have already reached fill factors (FF) exceeding 26% and 25%.

## ACKNOWLEDGMENT

This research has been supported by DIKTI (Directorate General of higher education) Ministry of Education and Cultures of Indonesia in the research project of BOPTN 2013.

## References

- [1] O' Regan, M Gratzel. A low cost, high efficiency solar cell based on dye-sensitized colloidal  $TiO_2$  folms. *Nature* 353 (1991) 737-739
- [2] M. Gratzel. Photoelectrochemical cell. *Nature* 414 (2001) 338-344.
- [3] S. Ito, T. N. Murakami, et.al, Fabrication of thinfilm dye sensitized solar cell with solar to electric power conversion efficiency over 10%, *Thin Solid Film* 516 (2008) 4613-4613.
- [4] M. Gratzel, Photovoltaic Performance and long-term stability of dye-sensitized solar meosocopic solar cell, *C. R. Chimie* 9 (2006) 578-583.
- [5] S. Ito, P. Chen, P. Comte, et. al, Fabrication of Screen Printing Pastes From  $TiO_2$  Powders for Dye-Sensitized Solar Cells. *Prog. in Photovoltaics: Research and Applications* (2007) DOI: 10.100/pip. 768.
- [6] M. Syahid, et. al, Recent Advancement in natural dye applications: a review. *Jurnal of Cleaner Production* (2013) 1-22.
- [7] I. K. Ding, J. M. Kyriazi, N. L. Cevey-Ha, et.al, "Deposition of hole-transport materials in solid-state dye-sensitized solar cells by doctor-blading, *Organic Electronic* 11 (2010) 1217-1222.
- [8] S. S. Kim, et. al, Annealing-free fabrication of P3HR:PCBM solar cell via simple brush painting, *Solar Energy Material and Solar Cell* 94(2010) 171-175.
- [9] V. W. W. Yam , *WOLEDs and Organic Photovoltaics*. New York: Springer-Verlag, 2010, ch. 1.

## EFFECTS OF TIME AND TEMPERATURE OF POLY ETHER ETHER KETONESULFONATION (sPEEK) ON THE SOLUBILITY OF sPEEK IN DIMETHYLACETAMIDE

**Muhammad Mujiburohman, Nur Hidayati, HerryPurnama, Siti R. Nihayati,  
Vendi Kurniawan, and Muhammad F. Hakim**

Department of Chemical Engineering  
Universitas Muhammadiyah Surakarta

Jl. A. Yani Tromol Pos 1 Pabelan Kartasura Surakarta

Email: mmujiburohman@ums.ac.id, mmujiburohman@yahoo.com

### **Abstract**

*This work aims at investigating the effects of time and temperature of PEEK sulfonation on the solubility of sulfonated PEEK (sPEEK) in the solvent of dimethylacetamide (DMAc), as a part of manufacturing Proton Exchange Membrane Fuel Cell. Using direct method, PEEK was sulfonated in high concentrations of sulfuric acid at temperature variations of 30, 50, and 70°C, for the period of times of 60, 90, and 120 minutes. Higher temperature and longer time of sulfonation resulted in finer size of sPEEK deposits. As predicted, the solubility tests showed that the finer sPEEK was dissolved better in DMAc.*

**Keywords:** poly ether ether keton, sulfonation, solubility, dimethylacetamide

### **BACKGROUND**

The dependence of energy on the fossil oil basis should now be reduced using alternative energy. Fuel cell is one of solutions of electrical energy sources with some advantages, i.e.: high energy efficiency (more than 60%), friendly environment, and can be applied in several applications. One of fuel cell types, Proton Exchange Membrane Fuel Cell (PEMFC), utilizes polymeric membrane as electrolyte material to transfer proton from anode to cathode. Today's, the commercial PEMFC uses Nafion; however, it is very costly. The utilization of cheaper material, as poly ether ether ketone (PEEK), is expected to be able to reduce the fuel cell manufacture cost. Since PEEK is a non-ionic material, it needs to be modified into ionic one hence having ability to conduct ions. The modification may be through sulfonation process or by adding other conductive materials. To be made into a non-porous homogeneous membrane, the sulfonated PEEK (sPEEK) must be dissolved in an appropriate

solvent before casting. In this case, the solubility of sPEEK in certain solvent becomes important parameter. In general, the recent work aims at modifying PEEK into an electrolyte polymer through sulfonation process. In the beginning step, the work investigates the ideal conditions of time and temperature of PEEK sulfonation reaction to obtain certain degree of sulfonation (DS), which eventually affects the degree of sPEEK solubility.

### **METHOD**

The research design applies group random method. The measured responses are sPEEK solubility in DMAc. Tabel 1 shows an illustration of factor combination used in this work.

Tabel 1. Design of experiment

	<i>t</i> 1 (60)	<i>t</i> 2 (90)	<i>t</i> 3 (120)
T1 (30)	T <sub>30t60</sub>	T <sub>30t90</sub>	T <sub>30t120</sub>
T2 (50)	T <sub>50t60</sub>	T <sub>50t90</sub>	T <sub>50t120</sub>
T3 (70)	T <sub>70t60</sub>	T <sub>70t90</sub>	T <sub>70t120</sub>

Notes:

*t* = time reaction (minute);

*T* = temperature reaction(°C)

Before sulfonation is carried out, the PEEK pellets are dried in an oven at 100°C and vacuum pressure. The dry PEEK is then dissolved and reacted with high concentrations of sulfuric acid at certain time and temperature of reaction. To stop the reaction, the solution is poured into icy water so that white deposits are found. The deposits are washed several times using deionised water until the waste-wash water has a neutral pH. Afterwards, the sPEEK is dried in an oven at room temperature for 12 hours, followed by another condition process of drying i.e. 60°C for 12 hours. At the end, the sPEEK deposits are dissolved by stirring in DMAc

with a ratio of sPEEK/DMAc = 10% weight at room temperature for certain period of time.

## RESULT AND DISCUSSION

The PEEK reacted (sulfonated) at 30 and 50°C for 60 and 90 minutes, resulted in deposits of sPEEK which were physically still as pellets. However, at reaction temperature of 70°C and all investigated time (60, 90, and 120 minutes) finer deposits of sPEEK were yielded. Some examples of sPEEK deposits are shown in Figure 1.



(a)



(b)



(c)

Figure 1. sPEEK sulfonated at 70°C and 120 minutes (a); at 70°C and 90 minutes (b); at 70°C and 60 minutes (c)

In fact, the different physical forms of sPEEK affect the solubility of sPEEK in the solvent of DMAc, as shown in Tabel 2.

Tabel 2. The solubility of sPEEK in DMAc

No.	Combination of Temperature ( <i>T</i> ) and Time ( <i>t</i> )	Qualitative Solubility
1	$T_{30}t_{60}$	Not dissolved
2	$T_{30}t_{90}$	Not dissolved
3	$T_{30}t_{120}$	Not dissolved
4	$T_{50}t_{60}$	Not dissolved
5	$T_{50}t_{90}$	Not dissolved
6	$T_{50}t_{120}$	Not dissolved
7	$T_{70}t_{60}$	Dissolved partially
8	$T_{70}t_{90}$	Dissolved partially
9	$T_{70}t_{120}$	Dissolved partially

It was reported that the solubility of sPEEK in several solvents as DMAc, dimethylformamide, and dimethylsulfoxide was affected by DS, a parameter representing the amount of sulfuric acid reacting with PEEK [Zaidi, 2003]. At DS 70% sPEEK was dissolved completely in those solvents. As a matter of fact, the ion exchange capacity (IEC), one of important parameters for a membrane as proton exchanger, is also affected by DS. Zaidi (2003) and Othman et. al. (2008) found that the level of DS was strictly proportional to the value of IEC, and both values were affected by the temperature of sulfonation reaction. Briefly speaking, higher temperature of sulfonation increases DS and IEC.

It must be noticed that the dissolution of sPEEK in DMAc solvent was conducted at room temperature; therefore, as shown in Table 2 no sPEEK were dissolved completely in DMAc. Theoretically, complete dissolution of solid materials can be achieved by increasing the temperature. Nevertheless, a representative sheet of membrane was still obtained as shown in Figure 2.



Figure 2. A sheet of membrane produced from  $T_{70}t_{120}$

## CONCLUSION

The time and temperature of sulfonation affects the physical forms (shape and size) of sPEEK deposits, which eventually affect the solubility of sPEEK in DMAc. In the range of investigated time of reaction (60-120 minute) at reaction temperatures of 30 and 50°C the yielded sPEEK is not dissolved DMAc. It is recommended to carry out the PEEK sulfonation at least at 70°C.

## References

Zaidi, Javaid S.M., 2003, Polymer sulfonation – a versatile route to prepare proton-conducting membrane material for advanced technologies, The Arabian Journal for Science and Engineering, Volume 28, No. 2B, p. 183 – 194.

Othman, M. H. D., Ismail, A. F. and Mustafa, A., 2007, Physico-Chemical Study of Sulfonated Poly(Ether Ether Ketone) Membranes for Direct Methanol Fuel Cell Application, Malaysian Polymer Journal, Volume 2, No. 1, p. 10 – 28.

## PSS - SMIB Simulation using PSIM & MATLAB software

<sup>1)</sup>Andi Imran, <sup>2)</sup>Hilmansyah, <sup>3)</sup>Mei Adetya, <sup>4)</sup>Yonny, <sup>5)</sup>Imam Robandi

<sup>1)</sup>Electrical Engineering Department ITS, Surabaya 60111, [andiimran7@gmail.com](mailto:andiimran7@gmail.com)

<sup>2)</sup>Politeknik Balikpapan, Balikpapan

<sup>3)</sup>Electrical Engineering Department ITS, Surabaya 60111

<sup>4)</sup>Electrical Engineering Department ITS, Surabaya 60111

<sup>5)</sup>Electrical Engineering Department ITS, Surabaya 60111, [robandi@ee.its.ac.id](mailto:robandi@ee.its.ac.id)

### Abstract

*This paper presents PSS SMIB simulation in PSIM and Matlab using PSS Plant in PSIM and using SMIB Plant in Matlab. The purpose of this research is to see the plant works by changing rotor angle ( $\Delta\delta$ ) using PSIM and Matlab software combined. Simulation result shows rotor angle changes ( $\Delta\delta$ ) using conventional PSS which gain undershoot at 2,5 second. While rotor angle changes ( $\Delta\delta$ ) with additional PID controller at SMIB which using PSS gain undershoot at 2 second*

**Key Words :** PSS, SMIB, and PID.

### INTRODUCTION

SMIB is a system to represent generation system which consist of some generator with single machine [1,2]. Generator connected to transformer, from transformer to line transmission, and then to infinite bus through equivalent impedance. Load change always influence system stability. So, bad respond from generator can cause frequency oscillation. A way to solve the problem is to install the PSS. Besides to solve the oscillation problem. PSS also applicable to decrease the voltage. The purpose using PSS can change depends on state of system. The system like inter-area mode and local mode. On local mode, oscillation become priority. The analysis about it always done at SMIB model [1].



Figure 1, SMIB System

### Method [1,2]

This simulation done by using MATLAB software and PSIM software. PSS plant done by PSIM software, while SMIB plant done by MATLAB software. Then, both connected by simulink simcoupler.

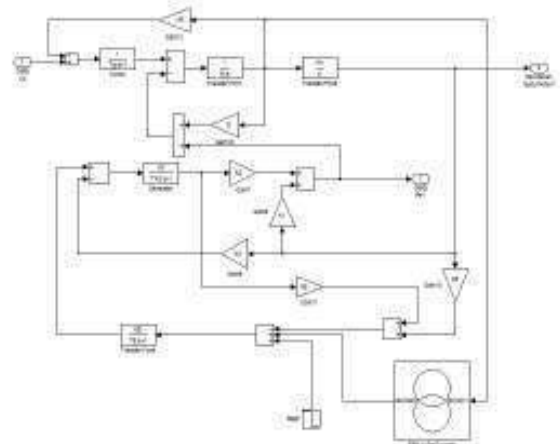


Figure 2, PSS SMIB Plant

1. SMIB simple modeling obtained as follow :

$$\Delta P_e = K_1 \Delta \delta + K_2 \Delta E'_q \dots \dots \dots (1)$$

$$\Delta E'_q = \frac{K_3}{1 + K_3 \tau'_{do} s} \Delta E_{FD} - \frac{K_2 K_4}{1 + K_3 \tau'_{do} s} \Delta \delta \dots \dots \dots (2)$$

With :

$\Delta P_e$  : electric power change.

$K_1$  : constant change of electric power for rotor angle change with constant flux

$K_2$  : constant change of electric power for flux with constant rotor angle

$K_3$  : impedance factor

$K_4$  : demagnetization effect from rotor angle change.

$\tau'_{do}$  : open loop time constant.

$\Delta\delta$  : rotor angle change  
 $\Delta E'_q$  : generator voltage change  
 $\Delta E_{FD}$  : field voltage change

The field voltage change ( $\Delta E_{FD}$ ) created by the terminal voltage change ( $V_t$ ) and the input signal ( $\Delta U_2$ ). If  $\Delta U_2 = 0$  then  $\Delta E_{FD}$  only depends on ( $\Delta V_t$ ), so the formula is :

$$\Delta E_{FD} = -\frac{K_E}{(1+\tau_E s)} \Delta V_t \dots\dots\dots(3)$$

Where :

$K_E$  : controller amplifier  
 $\tau_E$  : controller time constant  
 $\Delta V_t$  : terminal voltage change of machine

That formula developed by De Mello and Concordia [1], as follow :

$$\Delta V_t = K_5 \Delta\delta + K_6 \Delta E'_q \dots\dots\dots(4)$$

$K_5$  : voltage change on terminal with rotor angle change for  $E'_q$  is constant  
 $K_6$  : voltage change on terminal with voltage change  $E'_q$  for constant rotor angle

2. PSS simple modeling as follows:

$$T(s) = K_{STAB} \frac{s T_W (1+sT_1)(1+sT_2)}{1+T_W s (1+sT_2)(1+sT_4)} \dots\dots\dots(5)$$

Where :

$K_{STAB}$  : PSS amplifier  
 $T_W, T_1, T_2, T_3, T_4$  : time constant

time constant  $T_W$  can be selected in the range of 1 to 2s.  $T_1, T_2, T_3, T_4$  is time constant are chosen to provide a lead phase for input signal at a frequency range of 0,1 to 3,0 Hz.

3. PID control

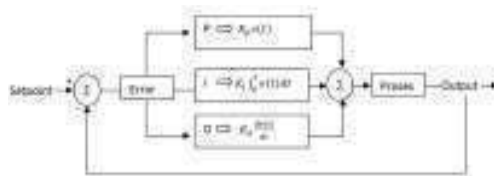


Figure 3, PID control

PID is a control consist of proportional, integral and derivative which has a feedback loop mechanism. PID control equation as follows:

$$u(t) = K_p e(t) + K_i \int_0^t e(t) dt + K_d \frac{ds(t)}{dt} \dots\dots\dots(6)$$

With :

$u(t)$  : output signal of PID controller  
 $K_p$  : proportional constant  
 $K_i$  : integral constant  
 $K_d$  : derivative constant  
 $e(t)$  : error signal = reference – output plant

## RESULT AND DISCUSSION

### Parameter SMIB

M=8;  $K_E=1$ ;  $T_E=2.019$ ;  $T=4.2$ ;  $T_g=48.440$ ;  
 $R=0.05$ ;  
 $\omega_r = (2 \times \pi \times 50)$ ;  $D=2$ ;  $K_1=1.755$ ;  $K_2=1.2578$ ;  
 $K_3=0.3072$ ;  $K_4=1.7124$ ;  $K_5=-0.0409$ ;  $K_6=0.4971$ ;

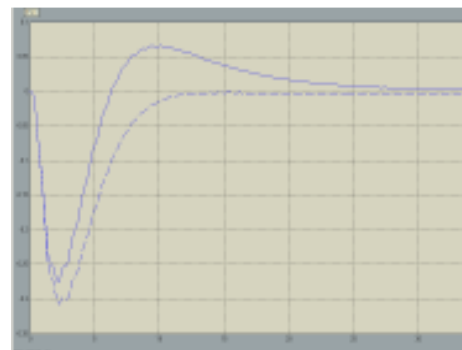


Figure 4, the simulation results of rotor angle change.

Description :

1. The dashed line shows graph of the rotor angle change with the conventional PSS
2. The blue line shows graph of the rotor angle change with PID controller on SMIB using conventional PSS.

SMIB with conventional PSS has undershoot at 2,5 s and additional PID for SMIB help PSS obtain undershoot at 2 s.

## CONCLUSION

1. Additional controller PID in SMIB help PSS to dump the undershoot, compare with non-PID controller
2. Overshoot on PID controler slightly high compare to PSS SMIB without PID, so is needed to be tuned by artificial intelligence (AI) to get a better performance.



**References :**

- [1] Imam Robandi, "Modern Power System Control", ANDI Yogyakarta.2009.
- [2] Imam Robandi, "Desain Sistem Tenaga Modern", ANDI Yogyakarta.2006.

## RENEWABLE ENERGY DISTRIBUTED GENERATION AS A SMART SOLUTION FOR THE ENERGY CRISIS IN INDONESIA

**Ramadoni Syahputra<sup>1,2</sup>**

<sup>1</sup>Department of Electrical Engineering  
Faculty of Engineering  
Universitas Muhammadiyah Yogyakarta  
Yogyakarta, Indonesia  
e-mail: ramadoni11@mhs.ee.its.ac.id

**Imam Robandi and Mochamad Ashari<sup>2</sup>**

<sup>2</sup>Department of Electrical Engineering  
Faculty of Industrial Technology  
Institut Teknologi Sepuluh Nopember  
Surabaya, Indonesia  
e-mail: robandi@ee.its.ac.id; ashari@ee.its.ac.id

### **Abstract**

*In this paper, we present a smart solution to solve the problem of energy crisis in Indonesia based on renewable energy. For purposes of analysis, we present performance analysis of wind turbine as a distributed generation unit. The wind power generation driven by asynchronous machine is a part of distributed generation which feeds ac power to the distribution network. The system is modeled and simulated in the Matlab Simulink environment in such a way that it can be suited for modeling of several types of induction generator configurations. The model makes use of rotor reference frame using dynamic vector approach for machine model. For studying the performance of the wind turbine system, both normal and fault scenario conditions are applied. Simulation results prove the excellent performance of the wind energy conversion system unit under normal condition in power distribution system.*

**Keywords:** distributed generation, wind turbine, asynchronous machine, performance analysis

### **INTRODUCTION**

Conservation of energy resources, environmental protection and sustainable development are the three major challenges that the world faces at present [1]. One important issue is to satisfy the energy needs of people without causing rapid depletion of the natural energy resources and degradation of the environmental. Distributed Generation (DG) is related with the use of small generating units, usually less than 30MW, that are

connected to transmission or distribution systems. The emerging new techniques such as small combustion turbines, fuel cells, wind energy, solar energy, and superconducting magnetic energy storage (SMES) make DGs more and more affordable and popular. The government of Indonesia has targeted that DGs from renewable energy resources for up to 25% of all new generation going online by the year 2025 [2]. The target has been emerged because the conventional energy sources are limited and have pollution to the environment.

Wind energy is the fastest growing and most promising renewable energy source among them due to economically viable [3-5]. Many applications of wind power can be found in a wide power range from a few kilowatts to several megawatts in small scale off-grid standalone systems or large scale grid-connected wind farms. During last two decades, the high penetration of wind turbines in the power system has been closely related to the advancement of the wind turbine technology and the way of how to control. Induction generators are receiving increasing attention for wind energy conversion system during such situation, because the main advantage of such machines is that, if the rotor current is governed applying field orientation control-carried out using commercial double sided PWM inverter, decoupled control of stator side active and reactive power results and the power processed by the power converter is only a small fraction of the total system power. So, induction machine with vector control is very attractive to the high performance variable

speed drive and generating applications [6-9]. With increasing penetration of wind-derived power in interconnected power systems, it has become necessary to model the complete wind energy systems in order to study their impact and also to study wind power plant control. In this paper, an attempt to develop a dynamic model of induction machine which can be simulated as both motoring and generating mode when testing control strategies. Through the model developed in this paper can be used for simulating all types of induction generator configurations. The induction machine is modeled in vectorized form in the synchronous reference frame. The speed is adjusted by the turbine pitch control to maximize the power generated at a given wind speed. A complete simulation model is developed for such machine under variable speed operation using MATLAB Simulink environment.

## FUNDAMENTAL THEORY

### Distributed Generation

Distributed generation (DG) sometimes provide the most economical solution to load growth. Low voltages or overloads that are created by load growth may only exist on a circuit for a small number of hours per year. There are many locations within the troubled circuit, or even in neighboring circuits, where a DG may be located to provide control needed to eliminate the low voltage or overload. We assume that it has already been justified that a DG provides the lowest cost solution to a circuit problem and is to be installed to provide the needed control. Placing DGs further out on the circuit can lead to improvements in losses, reliability, or both.

### Wind Energy Conversion System

There were several attempts to build large scale wind powered system to generate electrical energy. The first production of electrical energy with wind power was done in 1887 by Charles brush in Cleveland, Ohio.

Wind turbines convert the kinetic energy present in the wind into mechanical energy by means of producing torque. Since the energy contained by the wind is in the form of kinetic energy, its magnitude depends on the air density and the wind velocity. The wind power developed by the turbine is given by the equation (1) [10]:

$$P = \frac{1}{2} C_p \rho A V^3 \quad (1)$$

where  $C_p$  is the Power Co-efficient,  $\rho$  is the air density in  $\text{kg/m}^3$ ,  $A$  is the area of the turbine blades in  $\text{m}^2$  and  $V$  is the wind velocity in  $\text{m/sec}$ . The

power coefficient  $C_p$  gives the fraction of the kinetic energy that is converted into mechanical energy by the wind turbine. It is a function of the tip speed ratio  $\lambda$  and depends on the blade pitch angle for pitch-controlled turbines. The tip speed ratio may be defined as the ratio of turbine blade linear speed and the wind speed

$$\lambda = \frac{R\omega}{V} \quad (2)$$

Substituting (2) in (1), we have:

$$P = \frac{1}{2} C_p(\lambda) \rho A \left(\frac{R}{\lambda}\right)^3 (\omega)^3 \quad (3)$$

The output torque of the wind turbine  $T_{\text{turbine}}$  is calculated by the following equation (4):

$$P = \frac{1}{2} \rho A C_p \left(\frac{V}{\lambda}\right) \quad (4)$$

where  $R$  is the radius of the wind turbine rotor (m) There is a value of the tip speed ratio at which the power coefficient is maximum. Variable speed turbines can be made to capture this maximum energy in the wind by operating them at a blade speed that gives the optimum tip speed ratio. This may be done by changing the speed of the turbine in proportion to the change in wind speed. As one can see, the maximum power follows a cubic relationship [11]. For variable speed generation, an induction generator is considered attractive due to its flexible rotor speed characteristic in contrast to the constant speed characteristic of synchronous generator.

### System Modeling

In this research, physical model of the wind energy conversion system with asynchronous machine connected to grid of distribution system is implemented in Matlab Simulink software. The system models constituting elements of the system separately and also considers interrelationship among different elements within the system, where type and structure of the model is normally dictated by the particular requirements of the analysis, e.g. steady-state, fault studies, etc. Indeed, due to the importance of more realistic production of the behavior of asynchronous machine, it is intended to adopt physical model rather than functional model in order to accurately assess performance of asynchronous machine in the event of fault particularly in determining whether or not the generator will trip following a fault.

A wind farm consisting of six 1.5-MW wind turbines is connected to a 25-kV distribution system exports power to a 120-kV grid through a 25-km 25-kV feeder. The 9-MW wind farm is simulated by three pairs of 1.5 MW wind-turbines. Wind turbines

use squirrel-cage induction generators (IG). The stator winding is connected directly to the 60 Hz grid and the rotor is driven by a variable-pitch wind turbine. The pitch angle is controlled in order to limit the generator output power at its nominal value for winds exceeding the nominal speed (9 m/s). In

order to generate power the IG speed must be slightly above the synchronous speed. Speed varies approximately between 1 pu at no load and 1.005 pu at full load. Each wind turbine has a protection system monitoring voltage, current and machine speed.

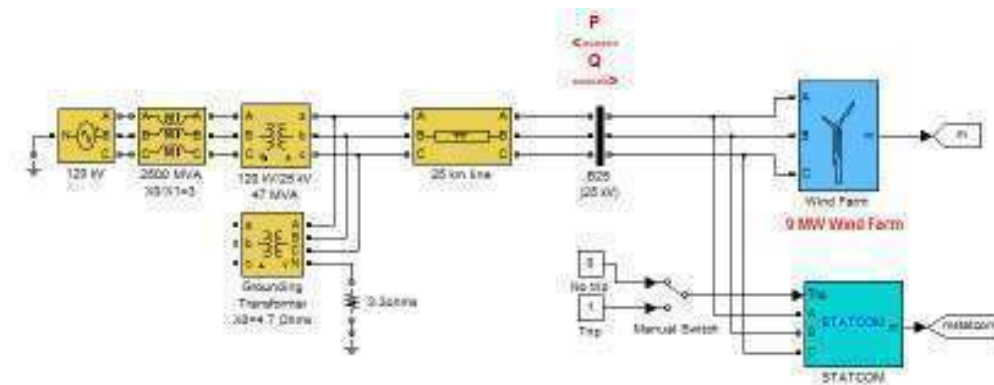


Fig. 1. Wind turbines connected to a distribution system

## SIMULATION RESULTS AND DISCUSSION

In order to analyze the performance of wind turbine as a part of distributed generation in power distribution system, the overall system is simulated using Matlab Simulink software. The simulation described in this section illustrates the steady-state and dynamic performance of a 9 MW wind farm connected to a distribution system. The wind farm consists of six 1.5 MW wind turbines connected to a 25 kV distribution system exporting power to a 120 kV grid through a 30 km 25 kV feeder. In this simulation, all of the system is observed during 20 s.

Figure 2 shows the wind turbine characteristics with pitch angle of 0°. It is shown that various wind speed will result in different turbine output power (in per unit of nominal mechanical power). The turbine mechanical power as function of turbine speed is displayed for wind speeds ranging from 4 m/s to 10 m/s. The nominal wind speed yielding the nominal mechanical power (1pu=3 MW) is 9 m/s. Figure 3 shows change of wind turbine pitch angle.

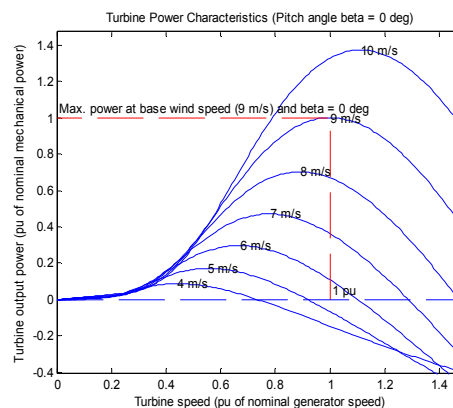


Fig.2. Wind turbine characteristics with pitch angle of 0°

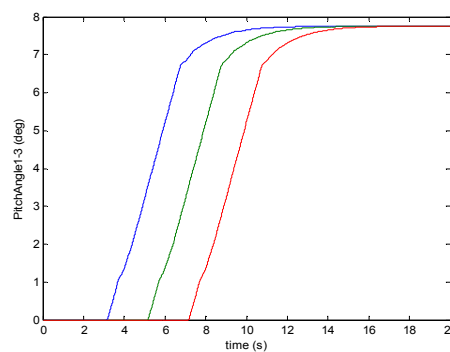


Fig.3. Change of wind turbine pitch angle

### Simulation Under Normal Condition

In this part, we have simulated power distribution system including wind turbine as distributed generation under normal condition. Simulation has started with monitoring active and reactive powers, generator speed, wind speed and pitch angle for each turbine.

Figure 4 and Figure 5 show the active and reactive power of wind turbine under normal condition, respectively. That figures illustrate each of the resulted active and reactive power of three pairs of wind turbines.

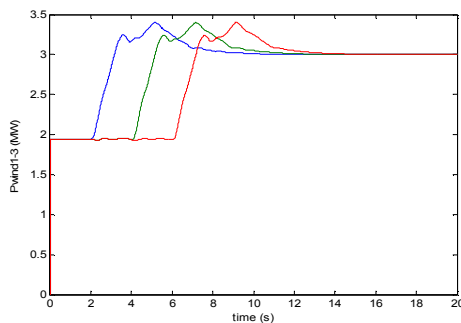


Fig.4. Active power of wind turbine under normal condition

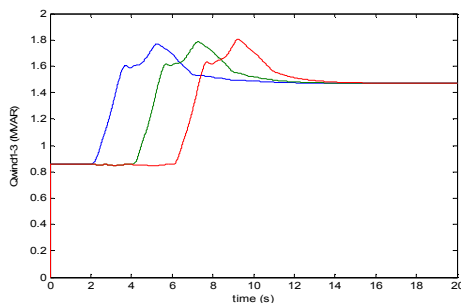


Fig.5. Reactive power of wind turbine under normal condition

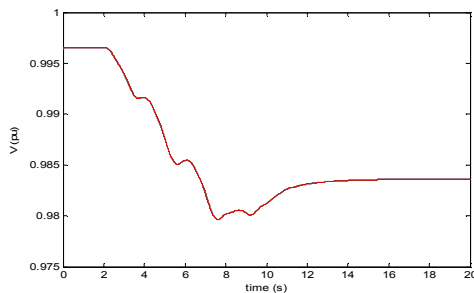


Fig.6. Voltage of bus B25 under normal condition

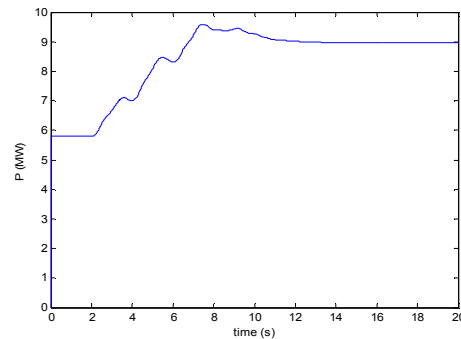


Fig.7. Active power of bus B25 under normal condition

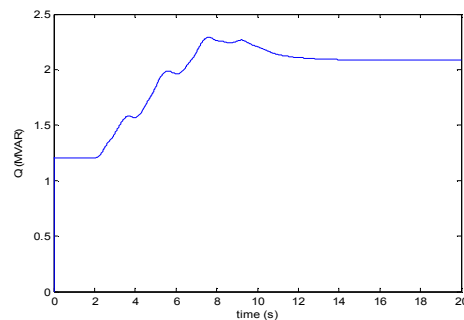


Fig.8. Reactive power of bus B25 under normal condition

Figure 6 shows the voltage magnitude of bus B25 (in per unit) under normal condition. The voltage has decrease from 0.997 pu to 0.980 pu in 8 s, and reached the final value of 0.984 pu in 12 s.

Figure 7 shows the active power of bus B25 under normal condition, while Figure 8 shows the reactive power of bus B25 under the same condition. Both active and reactive power of bus B25 have increased in 8 s, from 5.8 to 9.5 MW and from 1.2 to 2.3 MVAR, respectively.

### CONCLUSIONS

This paper has described the performance analysis of wind turbine as a distributed generation unit. The wind power generation driven by asynchronous machine is a part of distributed generation which feeds ac power to the distribution network. The system is modeled and simulated in the Matlab Simulink environment in such a way that it can be suited for modeling of several types of induction generator configurations. For studying the performance of the wind turbine system, normal scenario condition is applied. Simulation results prove the excellent performance of the wind energy

conversion system unit under normal condition in power distribution system.

# References

- L.L. Lai and T.F. Chan, "Distributed Generation, Induction and Permanent Magnet Generators", *John Willey and Sons, West Sussex*, 2007.
- A. Tapia, G. Tapia, J. X. Ostolaza, and J. R. Saenz, "Modeling and control of a wind turbine driven doubly fed induction generator", *IEEE Transactions on Energy Conversion*, Vol.18, pp. 194-204, 2003.
- Y. Lei, A.Mullane, G.Lightbody, and R.Yacamini, "Modeling of the Wind Turbine With a Doubly Fed Induction Generator for Grid Integration Studies", *IEEE Transactions on Energy Conversion*, Vol. 21(1), pp.257-264, 2006.
- H.Li and Z.Chen, "Overview of generator topologies for wind turbines", *IET Proc. Renewable Power Generation*, vol. 2, no. 2, pp. 123-138, Jun.2008.
- L. Mihet-Popa and F. Blaabrierg, "Wind Turbine Generator Modeling and Simulation Where Rotational Speed is the Controlled Variable", *IEEE Transactions on Industry Applications*, Vol. 40, No.1, Jan./Feb. 2004.
- S. Kim and E. Kim, "PSCAD/EMTDC-based modeling and analysis of a gearless variable speed wind turbine", *IEEE Trans Energy Conversion*, Vol. 22, No. 2, pp. 421-430, 2007.
- B.H.Chowary and S. Chellapilla, "Doubly-fed induction generator for variable speed wind power generation" *Transactions on Electric Power System Research*, Vol.76,pp. 786-800, Jan. 2006.
- M.A. Poller, "Doubly-Fed Induction Machine Models for Stability Assessment of Wind Farms", *Power Tech Conference Proceedings of 2003 IEEE Bologna*, Vol.3, 6 pp. 23-26 June 2003.
- J.G. Slootweg, S. W. H. Haan, H. Polinder, and W.L. Kling. "General Model for Representing Variable Speed Wind Turbines in Power System Dynamics Simulations". *IEEE Trans. on Power Systems*, Vol. 18, No. 1, February, 2003.
- B.C. Babu and K.B. Mohanty, "Doubly-Fed Induction Generator for Variable Speed Wind Energy Conversion Systems - Modeling & Simulation", *International Journal of Computer and Electrical Engineering*, Vol. 2, No. 1, pp. 1793-8163, February, 2010.
- S. Müller,M. Deicke, and R. W.De Doncker, "Doubly-fed induction generator system for wind turbines", *IEEE Industry Applications Magazine*, May/June 2002.
- T. T. Chuong, "Voltage Stability Investigation of Grid Connected Wind Farm", *World Academy of Science, Engineering and Technology*, Vol. 42, pp. 532-536, 2008.

## DESIGN OF DC VOLTAGE REGULATOR CONTROLLED BY BOOST CONVERTER CLOSE LOOP SYSTEM WITH STATIC LOAD USING PSIM

Abdil Jabbar Asyadili<sup>1)</sup>, Rodhi Kelvianto<sup>2)</sup>,  
Muhammad Taufiq Ramadhan<sup>3)</sup>, Imam Robandi<sup>4)</sup>

Department of Electrical Engineering, Faculty of Industrial Technology, ITS, Kampus ITS  
Sukolilo, Surabaya 60111, Indonesia

<sup>1)</sup>abdiljabbar071@gmail.com; <sup>2)</sup>rodhi.kelvianto@yahoo.com;

<sup>3)</sup>atreides\_03@yahoo.com; <sup>4)</sup>robandi@ee.its.ac.id

### Abstract

The Boost Converter has known for many years and applied on industries, which commonly used in open loop system to raise the voltage level. By adjusting the set point, we could determine the amount of the desired output voltage on the static load. However, the switch influence cause on ripple voltage and current. Then, we need a closed-loop system that can minimize the ripple. The research of Boost Converter in close loop system, give a better result. By installing the PID controller in feedback system, we could improve the performance of Boost Converter close loop system. The analysis of these system using PSIM software.

**Keywords:** Boost Converter, PID controller

### INTRODUCTION

The Boost Converter is one of many type DC to DC converter. Boost Converter has known for many years and applied on industries, which commonly used in open loop system to raise the voltage level. Boost converter circuit is capable of providing an output voltage higher than the input voltage. By adjusting the set point, we could determine the amount of the desired output voltage on the static load.

### BOOST CONVERTER

Boost converter circuit is capable of providing an output voltage higher than the input voltage. The basic formula of Boost Converter shown as [1] :

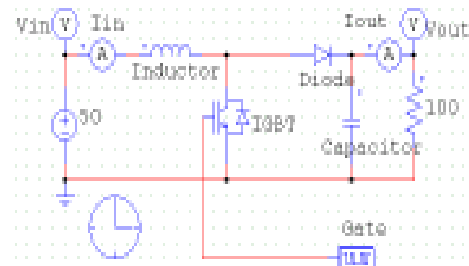
$$V_{out} = V_{in} \left( \frac{1}{1-k} \right) \quad (1)$$

$V_{out}$  = Output voltage to the static load

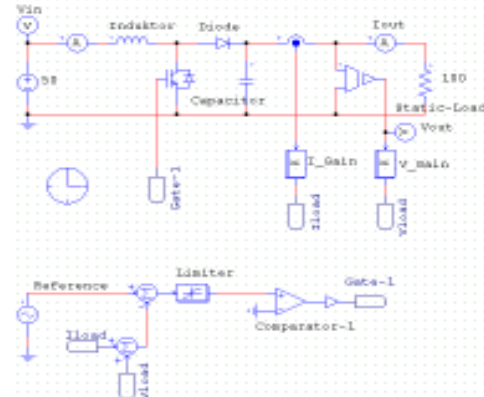
$V_{in}$  = Input voltage from the battery

$k$  = Duty Cycle =  $t_{on} / (t_{on} + t_{off})$

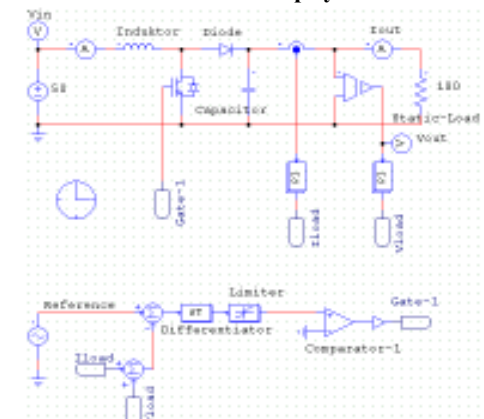
### Boost Converter in open-loop system



### Boost Converter in close-loop system



### Boost Converter in close-loop system with PID

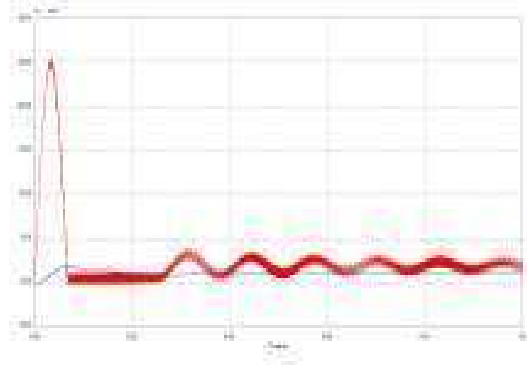


## RESULTS AND DISCUSSIONS

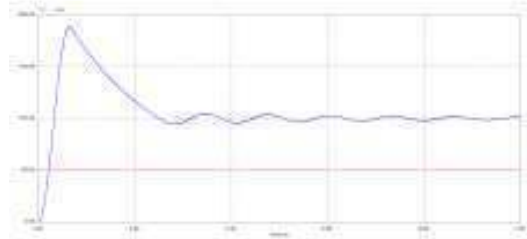
The result of simulation can be seen at these graphic pictures.

### Boost Converter in open-loop system

I-in and I-out



Vin and Vout



### Boost Converter in close-loop system

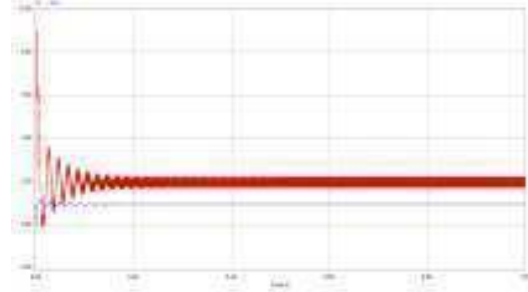
I-in and I-out



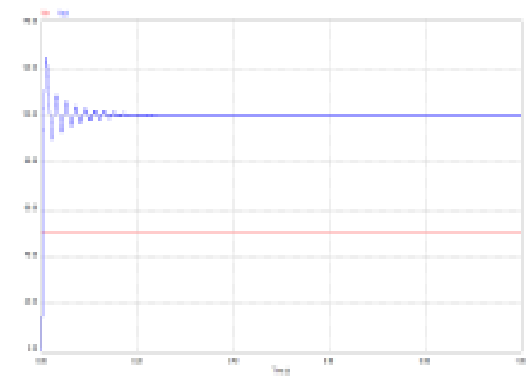
Vin and Vout



I-in and I-out



Vin and Vout



## CONCLUSIONS

This system shown a good result in raising the voltage level. But still need some improvement to gain a better result, as well as the selection of components which have the correct specification.

## References

- [1] Mochamad Ashari, "Sistem Konverter DC – Desain Rangkaian Elektronika Daya", ITS Press, 2012. Surabaya.
- [2] Katsuhiko Ogata, "Teknik Kontrol Automatik (Sistem Pengaturan) Jilid 1 - 2", Erlangga, 1985. Jakarta.



## IMPLEMENTATION OF ARTIFICIAL NEURAL NETWORK ALGORITHM AND PREPROCESSING WITH SOBEL ALGORITHM

**Nurvelly Rosanti and Nera Kholimah**

Informatic Engineering Course, Faculty of Engineering  
University of Muhammadiyah Jakarta

### **Abstract**

*To make a device computer able to identify something is not easy, inside the research we conducted a learning of the faces using Sobel preprocessing algorithm and artificial neural network algorithm namely backpropagation. How the way this algorithm works itself based in the way how human neuron brain system works, however this algorithm could never be compered with the ability of humans brain. With the result of its calculation, computer could possibly identify the pattern of images that have ben given,in this research the faces from Budi to Kodir. From the result of this research that using backpropagation algorithm it could be stated that it works identifying the faces given. Because it, this study made a face recognition application using matlab tools. Aplication test using white box and black box methode.*

**Keywords:** Sobel, Backpropagation, Face, Epoch, Alpha, Matlab

## **I. INTRODUCTION**

### **1.1. Background**

Face is one part of human that has different characteristics. Face has been used in field of information technology, for example, it can be used to recognize people for attendance, population data, and security system, with using face recognition system. Because human's face represents something so complex, therefore the development of ideal computation model for face recognition is a difficult matter. Besides, face recognition system also gets other difficulties such as the difference between face orientations, lighting, haircuts, moustache and beard, glasses, and different conditions like when he/she looked left/right or down/up. Artificial intelligence is one way to deal with the difficulties in reorientating different faces.

Technologies which using artificial intelligence as main component, are also widely used for face recognition application. This is due to artificial intelligence can think like human brain in order to take a decision. Artificial intelligence which are often tak about is artificial neural

network (ANN), also known as simulated neural network (SNN), or generally pronounced neural network (NN), NN is network from a group of mini processor unit, based on human's neural network. ANN is one of the information processing systems designed to imitate the way of how the human brain work to memorize and solve a problem by doing learning process through changes of it's synopsis weight. ANN are able to recognize activities based on data. Data will be learned by ANN so it has capability to giving decisions towards data that have not been learned before. So ANN can solves related problem by pattern classifications and matching, optimization, vector quantization and data grouping. Inside this artificial neural network, there are many algorithms, one of them is backpropagation algorithm.

This writing is made to apply a method of Backpropagation Algorithm by recognizing an image so that it can identified well through the utilization of theories like preprocessing with Sobel algorithm, artificial neural networks. Image that will be processed will be limited to image that represents face.

Recognizing a face image, can be done through detecting the edge of digital pattern image's face. These edge detection techniques, among other things, are Robert's Method, Canny's, Prewitt's, Sobel's, Gonzalez's, and Laplace's. Here, writer used Sobel's Method. This method is a development of Robert's, with the use of High Pass Filter, which given one zero number as buffer. This method takes principle of Laplacian and Gaussian Function, known as a function to raise HPF. Laplace or Laplacian is a transformation method used for solving differential equations that was initiated by Pierre Simon Laplace, while the Gaussian is one of the kind of noise that visible on image. This method was chose because it has advantage from other method, which was an ability to decrease noise before calculating edge detection.

Based on summary above, writer took on a theme in this final task "Creating face recognition application using artificial neural network algorithm and preprocessing with Sobel Algorithm".

## 1.2. Identifying Problem

A lot of researchs have been made in field of face recognition. Face recognition software using artificial intelligence as main component, in particular artificial neural network for processing and face identifying still not much to be found. The main problem that occur when about to recognizing a certain pattern and feeding it into an artificial neural network process is how to process acquisition is performed so it generates a number of numerical data which representative and konsisten to the sample that been given.

## 1.3. Problem Formulation

As for the formulation of the problem in this final Task is:

1. How does face recognition application creation process?
2. How to detect image of face recognition in the form of a photo which is the object of the image?
3. How to create an implementation that the input is actually the image converted to digital data?
4. How to turn digital images into binary code?
5. How to applicate the numerical-shaped data into facial recognition application?
6. How to analyze learning outcomes against a computer that was obtained from the implementation of facial recognition?

## 1.4. Boundaries of The Problem

In order of the problem that will be examined are not distorted and out of the theme of the thesis, then it needs a border problem. As for the constraints of the problem are as follows:

1. Data model face for every faces in the image samples take five times with the taking of a position object that has the specified one position up front, which are two left side position with each 45 degree position and the two right side position with the respective position of 45 degrees.

2. Data model faces does not use any barrier. Such as hoods, hats, and more.
3. The data model face is the male face model.
4. Testing was only done to 5 photos.
5. The image is the face of the image in black and white (grayscale) with light colored backgrounds and with extension Jpeg (\*.jpg).
6. Facial image's size is 300 x 400 pixels for each sample photos (5 photos).
7. The method used for edge detection is a method of sobel.
8. Method used for converting the image of a face is the Backpropagation neural network method.
9. Implementation that been used to make the converting the image into digital data is matlab version 7.10.0.499 (R2010a).
10. The manufacture of facial recognition application is using Matlab version 7.10.0.499 (R2010a) to create a preprocessing and backpropagation. Calculation of backpropagation will produce a value V and W, the result of V and W will be deposited into each database object.

## 1.5. Purposes and Benefits of Research

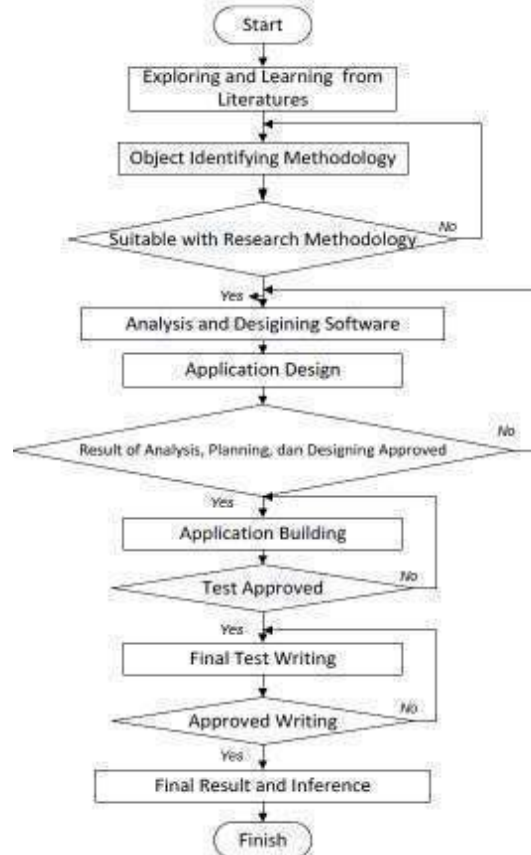
The purpose of this thesis is:

1. Making the application using facial recognition preprocessing with sobel algorithm and using artificial neural networks with backpropagation algorithm.
2. The application is expected able to classify the image data as well as recognize the image data.

Benefits in this thesis is:

1. Easy to process, identify and recognize objects or patterns of a given face.
2. The results of this research are expected to serve as a comparison for the other side who want to do more research and this research is expected to be able to add insights for readers.
3. As a means of auxiliary for the purposes of the investigation carried out by the parties concerned.

## 1.6. Research Methodology



Picture 1.1 Flowchart of Research Methodology

## II. THEORETICAL

### 2.1. Sobel Operator

Sobel is the development of Robert's method by using filter High Pass Filter (HPF) who was given a zero buffer. This method takes the principle of gaussian and laplacian functions known as a function to raise HPF. The advantage of this method of Sobel is the ability to reduce noise prior to the calculation of the edge detection.

Sobel Operator is one of the operators that avoid the computation of the gradient at the interpolation point. These operators use a kernel size of 3 X 3 pixels for calculation of the gradient so that the estimated gradient is right in the middle of the window. E.g. the arrangement of pixels around (x, y) pixel is:

$$\begin{bmatrix} a_0 & a_1 & a_2 \\ a_7 & (x,y) & a_3 \\ a_6 & a_5 & a_4 \end{bmatrix}$$

Base on the arrangement of the neighbor's pixels, the gradient magnitude which calculated using the sobel operator is

$$M = \sqrt{S_x^2 + S_y^2}$$

Where M is the gradient magnitudes at the midpoint of the kernel and the derivative partial is calculated using the following equation :

$$\begin{aligned} S_x &= (a_2 + ca_3 + a_4) - (a_0 + ca_7 + a_6) \\ S_y &= (a_0 + ca_1 + a_2) - (a_6 + ca_5 + a_4) \end{aligned}$$

Where C is a constant which is valued by 2.  $S_x$  and  $S_y$  which implemented into the kernel is :

$$S_x = \begin{bmatrix} -1 & 0 & 1 \\ -2 & 0 & 2 \\ -1 & 0 & 1 \end{bmatrix} \text{ and } S_y = \begin{bmatrix} 1 & 2 & 1 \\ 0 & 0 & 0 \\ -1 & -2 & -1 \end{bmatrix}$$

It appears that the sobel operator uses a weighting on pixels are closer to the center point of the kernel. Therefore, the influence of the neighbouring pixels will be in accordance with the location of the point where the gradient is calculated. In calculating this gradient, this operator is a combination of horizontal position and vertical position.

The edge direction is calculated with the equation:

$$a(x,y) = \tan^{-1} \left[ \frac{S_x}{S_y} \right]$$

### 2.2. The Architecture of Artificial Neural Network

The connections between neurons in the artificial neural network are follow a certain patterns, depending on the network architecture of its nerves. There are basically three kinds of neural network architecture, that is:

1. Neural networks with a single layer (single layer net).

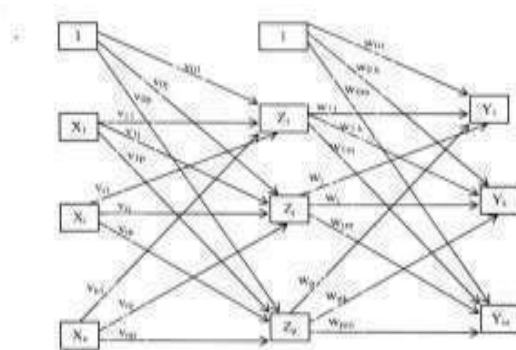
Network with a single layer which only has one layer with weights are connected. This network only accepts direct input then will turn it into the output without having to go through a hidden layer. In other words, the characteristics of the architecture of neural networks with a single layer is the only layer consists of one input and one output layer with no hidden layer.

2. Neural networks with many layers (multilayer net).

A network with many layers have one or more layers that lie between the layers of the input and output layers (having one or more hidden layers). Generally there is a layer of weights between 2 adjacent layers. A network with many layers like this can solve more difficult problems than single layer with a layer, despite with more complex learning.

### 3. Neural networks with a competitive layer (competitive layer net).

This architecture has different forms, where between neurons can be exchanged at connect.



Picture 2.1. The Architecture of Backpropagation Neural Network

Description of the picture are as follows: The architecture of Backpropagation neural network algorithm has three layers of neurons input:  $X_1$ ,  $X_i$  and  $X_n$ , three of hidden layer neurons i.e.  $Z_1$ ,  $Z_j$ , and  $Z_p$ , also has three output layers, namely:  $Y_1$ ,  $Y_k$ , and  $Y_m$ . And two layers of bias. Where  $V_{01}$  is a value of the connector which connecting bias layer with a hidden layer i.e. the  $Z_1$ . As for the  $V_{11}$  is a value of the connector which connecting the input  $X_1$  layer with a  $Z_1$  hidden layer. For  $W_{1j}$  is a value of the connector which connecting the  $Z_1$  hidden layer with output  $Y_1$ .

Artificial neural network operations can be expressed in several layers include:

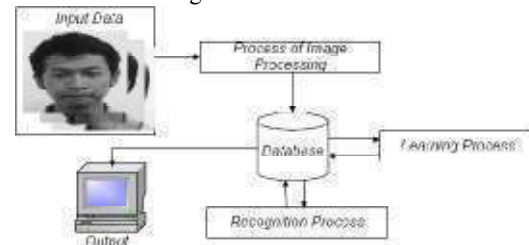
1. Input layer: point on this layer serves to accommodate and propagating the signal to the next layer.
2. Hidden layer : this layer located between input layer and output layer. This layer serves to process signals in the form of transformation of neurons.
3. Output layer : the resulting expenditure layer through artificial neural network operation process.

## III. DESIGNING FACE RECOGNITION SYSTEM

### 3.1. Analyzing Requirements of the System

Artificial Intelligence is one part of computer science that aims to make the machine (computer) can do the job as good as and man. Examples of artificial intelligence-based system is a system of images recognition using artificial neural networks. There are two types of learning methods on

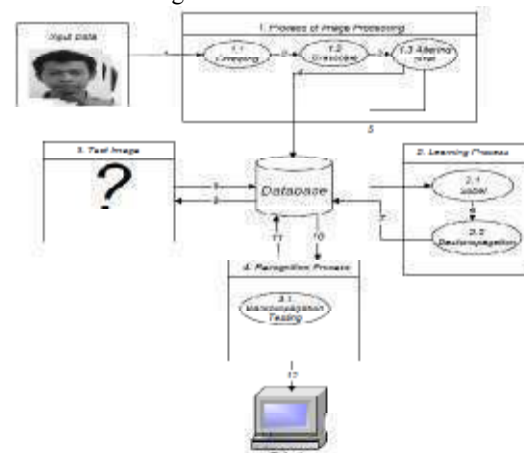
artificial neural networks, namely supervised learning and unsupervised learning. To do facial recognition, supervised learning is more suitable because it uses the target output. Backpropagation is one example of supervised learning method. In addition to use the backpropagation method, we require preprocessing. One method that we use to preprocessing is the Sobel method. Sobel method is the ability to reduce noise prior to the calculation of the edge detection. Results of the edge detection will characterizing each face.



Picture 3.1. The Analysis of System's Requirements

### 3.2. Analysis of the Process

On the explanation of the system analysis has been described that this system has four main processes, each process has a sub process that has a role in face recognition.



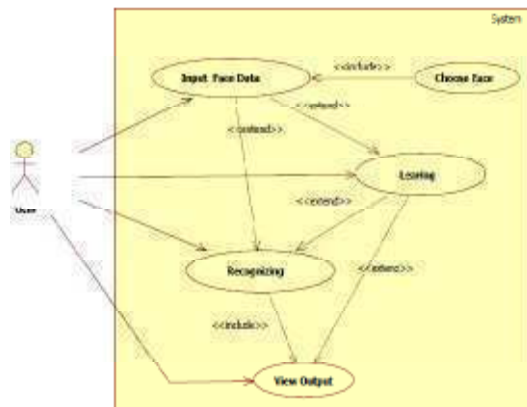
Picture 3.2. Analysis of the Process

### 3.3. Analysis of Functional Requirements

Functional requirement analysis describes the processes that happen in this application. The processes described in the use case diagram, and activity diagram.

#### 3.3.1. Use Case Diagram

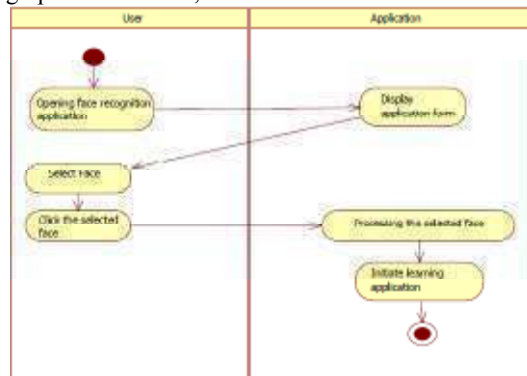
Use case diagrams describe the process that exists in this application. the application of use case diagram is illustrated in the picture below:



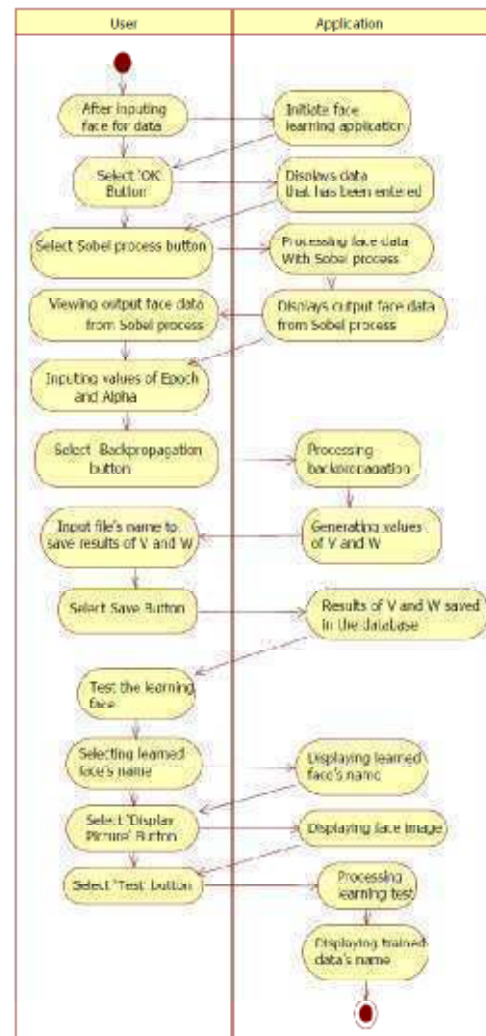
Picture 3.3. The Use Case Diagram of Face Recognition Application

### 3.3.2. Activity Diagram

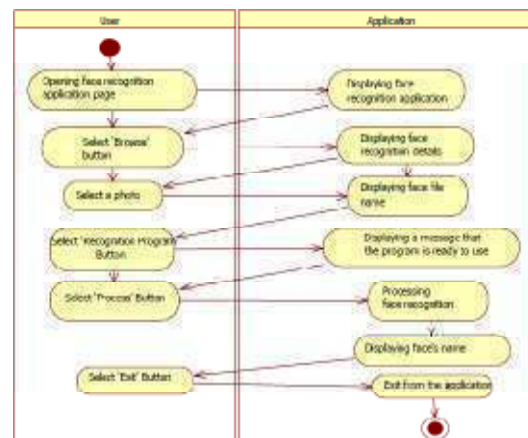
Activity diagrams are one way to model events which occur in a use case. This chart can also be replaced with some text. However, the use of the text is sometimes very difficult to understand, especially if the flow of events convoluted and has many alternatives. In this last case, it is often due to activity diagrams are graphical in nature, make it easier to understand.



Picture 3.4. Face Input Activity Diagram



Picture 3.5. Face Image Learning Activity Diagram

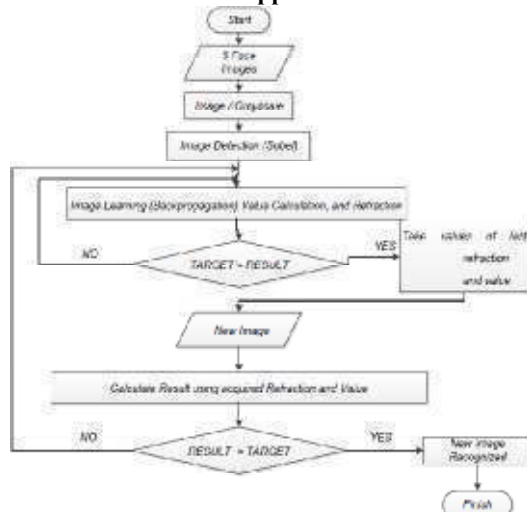


Picture 3.6. Face Identification Image Activity Diagram (TA, 2013)



## IV. CREATING THE APPLICATION AND FACE IDENTIFYING TEST

### 4.1. Flowchart of the Application



Picture 4.1. Application Proses Method Flowchart

## 4.2. Application Testing

### 4.2.1. Black Box Testing

Black box testing aims to demonstrate the functionality of the software about how it operates, whether data input output has gone as expected.

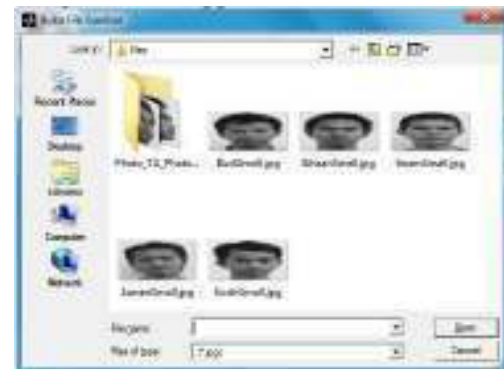
#### 4.2.1.1. Tampilan Input

The input display can be seen in the picture below :



Gambar 4.2. Tampilan Input

In picture 4.2. The input page is displayed. On the input page is the process of entering data objects or faces has been done. Select the Browse button to select a face object will be given instructional, if you select the browse button the open the image file will appear below:



Picture 4.3. Picture Browse Interface

After you select one object, then the object's face will appear, and then click the face so that it can enter into the learning process.

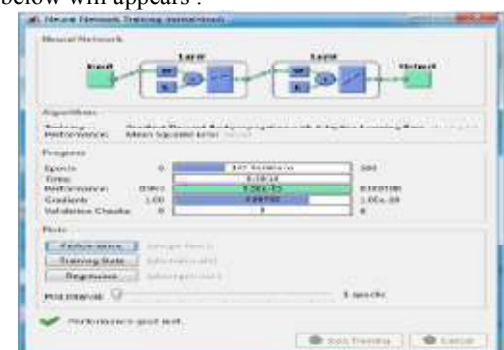
#### 4.2.1.2. Process Interface

Learning or process interface is the learning process of each object. The display process can be seen in the picture below :



Picture 4.4. Process Interface

Picture 4.4. In the process, the page displayed in the processing page, processing has been done doing edge detection process using Sobel algorithm. And then enter the value of the epoch and alpha to do neural network process with backpropagation algorithm. At a time when the process of backpropagation is working, picture below will appears :



Picture 4.5. Neural Network Training Picture

After the process of neural network testing is completed, it will produce a value V and w. results of V and W is then stored in a.txt file. When you do the process to save then it will display the message as below :



Picture 4.6. Saving Process Message

Facial recognition test will be done to test the training data is known or not.



Picture 4.7. Face Recognition Test

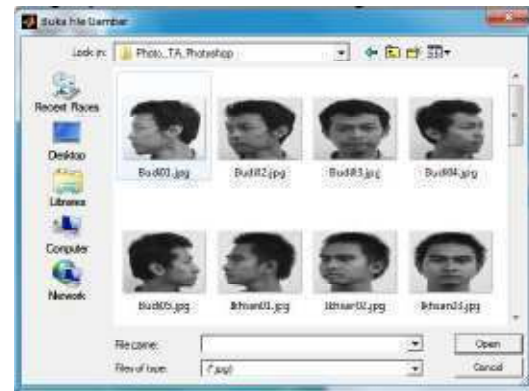
#### 4.2.1.3. Output Display

Display of the output is the process of testing to test the object face will be known or not.



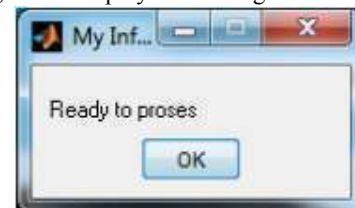
Picture 4.8. Output Display

If you clicked the Browse button, then the display will show up below :



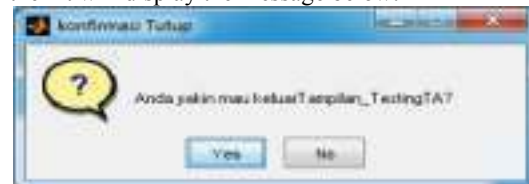
Picture 4.9. Browse Display in Output

Then click the button Program Introduction, if clicked, it will display the message as below :



Picture4.10. Recognition Program Message Display

After that press the Process button, this function to process the face object or testing face object so it can identify all the face objects that have been learned. And if you click the Exit button then it will display the message below:



Picture 4.11. Exit Message Display

If you click Yes, then you will be got out from the application.

#### 4.2.2. White Box Testing

The application testing using the direct testing method based on the white box test technique on the flowchart that create applications to be effective and efficient. Testing hypotheses using the white box testing techniques on the flow of the program, logic structure of the program and the procedures of the program, by the way of mapping your flowchart into flowgraph, then calculate the total number of nodes and edges where this number of edges determine the magnitude of the cyclomatic complexity. On calculation of cyclomatic complexity if :

1.  $V(G) = E - N + 1$  result is equal to  $V(G) = P + 1$
2. Flowgraph has a same region of amount of  $V(G)$  then the system has been proven to be effective and efficient.

To find out the working process of the software internally

To ensure internal operations in accordance with the specifications that have been set using the control structure of the procedure being designed.

Region (R) = 3

R1 = Overall

R2 = 6, 7, 8, 9

R3 = 12, 13, 14, 15

Edge (E) = 17

Node (N) = 16

Predicate Node =  $R - 1$

=  $3 - 1$

= 2

P1 = 6

P2 = 12

Calculations :

1.  $V(G) = E - N + 2$

$$\begin{aligned} V(G) &= E - N + 2 \\ &= 17 - 16 + 2 \\ &= 3 \end{aligned}$$

2.  $V(G) = P + 1$

$$\begin{aligned} V(G) &= P + 1 \\ &= 2 + 1 \\ &= 3 \end{aligned}$$

3. Cyclomatic complexity (CC) = R1, R2, R3

Based on the results of the white box testing above, it can be concluded that the flowchart is correct. Test results above indicate the application of the test case method with white box testing approach can produce applications and processes in the flowchart on the applications to be effective and efficient.

## V. CONCLUSION

### 5.1. Conclusion

From the results of the analysis of this final Task, can be summed up as follows:

1. the final assignment is done by give learning to the computer to accept input in the form of facial image. The facial image is later changed to grayscale and then made the edge detection process using Sobel Algorithm.
2. It is true that the Backpropagation algorithm can recognize the faces that are tested in this study.
3. This final project using epoch, alpha, layer, and neurons. The size of Epoch used in this final Task is 500, the size of Alpha used in this final Task is 0.0001, whereas the amount of Layer and

neuron used in this final project is a 2 layer and 4 neurons. This final project using Epoch 500 and Alpha 0.0001 because according to the specifications of the laptop, which is Intel Core i3 and 4 GB of RAM. The specification is considered to be the most optimum. If the Epoch and Alpha in the process then the training process will be much longer.

4. The computer is able to recognize all the image face provided to it.

### 5.2. Advice

In the making of learning applications to this computer, writer has been written advices from the final task such as follows:

1. The sum of the face and facial position variation can be augmented in number.
2. We recommend that Researchers can then change the value of the epoch and alpha (Add number of the layer if necessary), so that the faces of Budi, Ikhsan Jumeri, Imam, and Kodir that already examined can be recognized properly.
3. We recommend that you make a direct interface that can recognize the face without using 2 programs as it has been created.
4. In the event of changes in the face of such an accident and underwent a change of face. We recommend to make tools that can keep track of changing faces.
5. This application of learning is less than perfect. For those wishing to develop it more perfect, it is recommended to add the number of layers and neurons.

## References

- Away, Gunaidi Abdia, The Shortcut Of Matlab Programming: Informatika.
- C.gonzales rafael, dan E.woods Richard, Digital Image Processing, New Jersey: Prentice-Hall, Inc, 2002.
- Kusumadewi, Sri dan Hartati, Sri, Neuro Fuzzy Integrasi Sistem Fuzzy & Jaringan Syaraf, Yogyakarta: Graha Ilmu, 2010.
- Kusumadewi, Sri, Membangun Jaringan Syaraf Tiruan Menggunakan Matlab & Excel Link, Yogyakarta: Graha Ilmu, 2004.
- Munir Rinaldi, Pengolahan Citra Digital Dengan Pendekatan Algoritmik, Bandung: Informatika, 2004.
- Nakamura, Shoichiro, Numerical Analysis and Graphical Visualization with Matlab, Prentice Hall PTR, Upper Saddle River, NJ 07458.
- Nugroho, Adi, Rational Rose Untuk Pemodelan



- Berorientasi Objek, Bandung, Penerbit Informatika, 2005.
- Nugroho, Adi, Rekayasa Perangkat Lunak Menggunakan UML dan Java, Yogyakarta: Andi Offset, 2009.
- Paulus, Erick, S.Si, M.Kom., dan Nataliani, Yessica, S.Si, M.Kom., Cepat Mahir GUI Matlab, Yogyakarta: Andi Yogyakarta, 2007.
- Prasetyo, Eko, Pengolahan Citra Digital dan Aplikasinya Menggunakan Matlab, Gresik: Andi Yogyakarta, 2011.
- Purnomo, Mauridhi Hery dan Kurniawan, Agus, Supervised Neural Networks dan Aplikasinya, Surabaya: Graha Ilmu, 2006.
- Sholih, Pemodelan Sistem Informasi Berorientasi Objek dengan UML, Yogyakarta: Graha Ilmu, Edisi 1, 2006.
- Siamg, Jong Jek, M.Sc, Drs., Jaringan Syaraf Tiruan & Pemrogramannya Menggunakan Matlab, Yogyakarta: Andi Yogyakarta, 2004.
- Sutojo, T.S.Si, M.Kom. dan Mulyanto, Edy, S.Si, M.Kom., dan Suhartono, Vincent, Dr., Kecerdasan Buatan, Yogyakarta: Andi Yogyakarta, 2010.
- Widodo, Prabowo Pudjo, dan Handayanto, Rahmadya Trias, Penerapan Soft Computing Dengan Matlab, Bandung: Rekayasa Sains, 2009.
- , <http://repository.usu.ac.id/bitstream/123456789/31325/4/Chapter%20II.pdf>. (Senin, 08 Oktober 2013: jam 18.00)
- , <http://id.wikipedia.org/wiki/Wajah> (Minggu, 14 Oktober 2013 jam 21:27)
- , <http://repository.usu.ac.id/bitstream/123456789/29726/4/Chapter%20II.pdf> (Senin, 22 Oktober 2013 jam 16:13)

## PREDICTION OF TEST ITEMS VALIDITY USING ARTIFICIAL NEURAL NETWORK

Hindayati Mustafidah<sup>1)</sup>, Sri Hartati<sup>2)</sup>, Retantyo Wardoyo<sup>3)</sup>, Agus Harjoko<sup>4)</sup>

<sup>1)</sup> Informatics Engineering – Muhammadiyah University of Purwokerto  
(Computer Science Doctoral Student – FMIPA – Gadjah Mada University)

<sup>2) 3) 4)</sup> Computer Science – FMIPA – Gadjah Mada University  
h.mustafidah@ump.ac.id

### **Abstract**

*One of the objectives of the evaluation of learning activities is to know the quality of the test items used in the evaluation. One of the indicators of the quality of the items is the validity of which is interpreted as a measure of the legitimacy problem. So far in judging the validity of the items used the calculation score obtained from the results of the work of the students using the product moment correlation. But with the development of computer software technology, the determination of the validity of the reserved data can be done without a feedback from students but based on the experience of previous information. The technique used is a neural network, is a system that processes the information that has characteristics resembling the human nervous tissue (Human Neural Network). With input in the form of the classification items reserved based on the level of cognitive aspects, it can be predicted its validity level. The neural network architecture used is multi-layer network with a single hidden layer and backpropagation training algorithm and using sigmoid activation function.*

**Keywords:** learning evaluation, validity, neural networks, backpropagation

### **BACKGROUND**

The test items used in a measurement of the results of the study should be considered well before used. The test must have a quality, namely the test items is considered good quality before used to a measurement, will remain be a good quality after a measurement is carried out.

Feedback about the quality of tests will be acquired, if scores were reviewed obtained from a measurement. One type of examination of the items is validity [1]. Validity is a measure that indicates the level of validity of an instrument. A test is said to have validity if the result corresponds to a criteria, in the sense of having suitable between the test results and criteria [2]. A test called valid if the test were able to precisely measure what is measured. If the data that is retrieved from a valid instrument, it can be said that the instrument is valid as it can give an idea of the data correctly in accordance with fact or circumstance. In doing the analysis of validity about commonly used formula correlation product moment [3]. A test is said to have the validity of the construction when the details matter that build these tests measure every aspect of thinking like a special Instructional Purposes mentioned. Construction in this sense is psychological invention itemize the contents of several aspects such as: remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6) better known as the Anderson-Krathwohl's taxonomy (revised of Bloom Taxonomy) [4].

The fact is, until recently rarely carried out an evaluation of the validity of the test items have been compiled by reason of lack of availability of time to do a test items and the use of mathematical formulas that proved difficult. Based on some research that has been done in some schools in the Regency of Banyumas and surrounding areas of the test items, that the level of the validity of the question has not met the standards of a quality test as seen in Table I below.

Table I. Results of the research of items analysis in a Banyumas Regency and surroundings

School	Subject	Categories in Anderson-Krathwohl's Taxonomy	Results of Validity Analysis
High School	Mathematic	C1: 13.33% C2 : 6.67% C3 : 70% C4 : 10%	Low
	Biology	C1 : 50% C2 : 30% C3 : 10% C4 : 10%	Low
Junior High School	Mathematic	C1:17,65% C2:55,88% C3:17,65% C4:8,82%	Low
Elementary School	Citizenship Education	C1 : 20% C2 : 35% C4 : 45%	Very Low

Source : Results of Items Analysis in 2003, 2004, 2005 of Banyumas Regency and surroundings ([5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15]).

In spite of such data is known that turned out to be met quality standards that are expected, but there has been no real effort to improve the quality of the items. Similarly, results of the survey in the form of interviews with some of the teachers in Banyumas Regency, they rarely perform analysis or evaluation of the test items that they are stacking to determine the level of accuracy of the reserved as measuring instrument for learning which is done, even though it has several tools available in the form of computer programs including "ANATES" [16] and the "evaluation" [17].

This problem can be overcome if utilized one of the results of the development of science and technology in the form of computer software. This time the computer can be designed to think like a human thinker. One of the science in the field of computers that can do the thinking or reasoning like a human being exists in the science of artificial intelligence/AI [18]. One of the fields of AI which is able to do as the reasoning and learning process of the human brain is a Neural Network (ANN).

Artificial Neural Network/ANN is defined as an information processing system which has characteristics resembling human Biological Neural Network (BNN) [19]. Neural network is the ideal solution for problems that can't be easily formulated using an algorithm [20]. Neural networks can learn from their experiences, do a

generalization of acquired examples and abstract of the essential input characteristics and even for data that is not relevant. ANN algorithm operates directly with the numbers so that no numerical data should be converted into numerical data. ANN is not programmed to produce specific outputs. All of the outputs or the conclusions drawn by the network are based on its experiences during the learning process. On the process of learning, into ANN put the patterns of input (and output) and the network will be taught to provide answers that could be accepted. At the ANN, neurons will be collected in layers called neuron layers. Neurons at one layer will be linked with the layers before and afterwards. The information provided on the network will be forwarded from the layers to layers, starting from the input layer to the output layer through hidden layer [21]. These hidden layers can consist of one or more layers. The success of a network learning process demonstrated by the minimum error that obtained. When there are new things that should be known by the ANN so the learning process should be repeated again by using the old information that coupled with the new information. There are several models of neural networks, but in major practical application use backpropagation. According to [7], more than 90% of applications in the field of industrial and commercial use backpropagation model or its

derivatives in building neural network system. Some applications of ANN ever developed is hybrid system ANN and fuzzy logic to predict a student's GPA that based on the average value of the Graduate Scores, discipline, and learning motivation [22] and ANN to predict students learning achievement (GPA) based on marks at the national examination subjects obtained in High School [23].

Based on these problems, then in an attempt to find out the level of validity test applied an ANN method. This method is used to predict the quality of test items based on the data that has been previously obtained through the learning process. The expected benefit of this research is to provide support for education world, especially for authors of tests to find out about the predictions of test validity without having to wait for the results of the work of the students.

#### METHODE

Research data obtained from the documentation about test items and the results of the analysis that has been done manually from several groups reserved (which consists of the socials and sciences). This data is training data trained in ANN. Procedurally this research developed through the following phases:

- Define the input  
The Input data is a set of test items analysis from trial results of tests i.e. percentage classification of Anderson-Krathwohl's taxonomy.

- Define the output  
The output is predictive validity level of test items.
- Determine the network parameters  
These parameters include the number of the maximum allowable epoch, learning rate, and target error.
- Select the activation function  
The activation function used is non-linear (sigmoid) because the network was used is multi layers network.
- Determining the number of hidden layer  
The number of hidden layer that is used is one (singular) with the backpropagation training algorithm

#### RESULT AND DISCUSSION

The ANN system was designed is one input layer consisting of 6 neurons, one hidden layer with 10 neurons, and one output layer with 1 neuron. Neurons in the input layer is the data input in the form of test items percentage included in the categories of C1, C2, C3, C4, C5, C6. The neuron in output layer is the average level of the validity of the test items. The hidden layer is a balance between the ability of the network to recognize the patterns that are used for training and networking ability to respond properly to the input pattern similar to patterns of training. There is no specific formula to find the optimal number of neurons in the hidden layer [24]. Therefore, in this study used 1 hidden layer with 10 neurons in the hope it could provide more accurate results. Neural network scheme used presented in Figure 1.

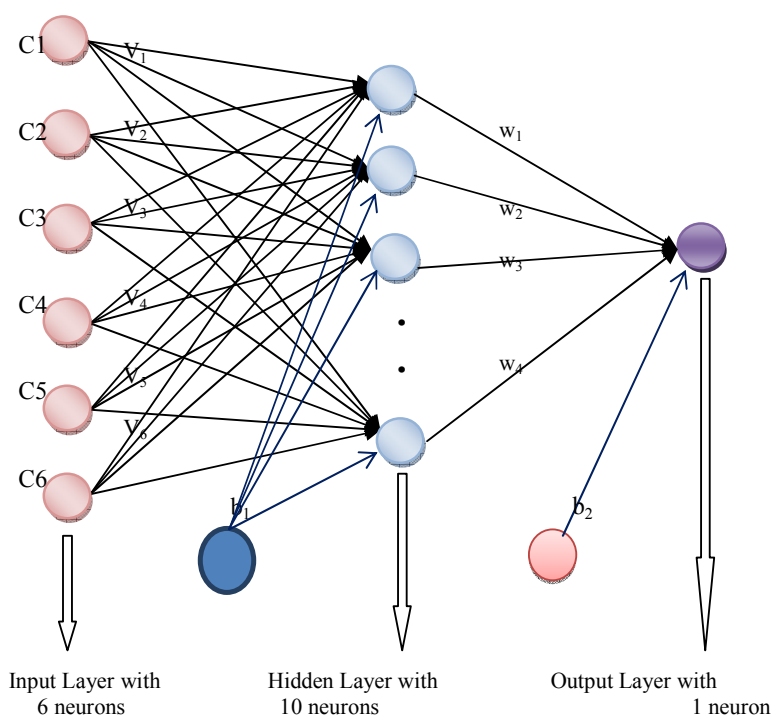


Figure 1. ANN Scheme used in this research with 1 input layer (6 neurons), 1 hidden layer (10 neurons), and 1 output layer (1 neuron)

In addition to the number of neurons in the hidden layer, the other parameters in the network that is used are the number of maximum allowable epoch = 1000, error target =  $10^{-3}$ , learning rate = 0.05.

Training network performed against the data in Table II ([5], [6], [7], [8], [9], [10], [11], [12], [13], [14], [15]) using the source code with MATLAB language.

Table II. Data of validity test items with compositions according to Anderson-Krathwohl's Taxonomy category

Items	Sum of Items	Compotitions (%)						Validity Score
		C1	C2	C3	C4	C5	C6	
1	20	20	35	0	45	0	0	0.351
2	20	50	30	10	10	0	0	0.419
3	50	48	42	6	4	0	0	0.123
4	30	60	36.67	3.33	0	0	0	0.218
5	45	28.89	37.78	26.67	6.67	0	0	0.190
6	50	40	38	8	14	0	0	0.181
7	35	42.86	48.57	5.71	2.86	0	0	0.3
8	25	76	24	0	0	0	0	0.31
9	25	36	28	28	8	0	0	0.208
10	30	16.67	56.67	23.33	3.33	0	0	0.752
11	35	14.29	62.86	20	2.86	0	0	0.296
12	35	17.14	57.14	17.14	8.57	0	0	0.345
13	32	18.75	12.5	59.38	9.38	0	0	0.232
14	32	12.5	6.25	71.88	9.38	0	0	0.205
15	32	12.9	9.68	67.74	9.68	0	0	0.186

Backpropagation training algorithm using error output to change the values of the weights in backward direction. To get this error, forward propagation phase must be carried out first. At the time of forward propagation, neurons are activated by using the activation function which can be derived i.e. tansig.

$$y = f(x) = \frac{e^x - e^{-x}}{e^x + e^{-x}}$$

$$\text{or } y = f(x) = \frac{1 - e^{-2x}}{1 + e^{-2x}}$$

$$f'(x) = [1 + f(x)][1 - f(x)].$$

The final goal of the ANN process is finding the values of weights on each layer. This weights which is then used as a parameter in the calculation of the input data to be searched on the output.

In 50 times the experiment running the program with the same test data with data training, obtained the results that the network gave an average of 86,54% data match with the level of error 0.00063347. Final weight of the network is obtained as follows:

- The final weights of the input layer to hidden layer ( $v_i$ )

0.0476	0.0316	-0.0068	0.0783	0	0
-0.0586	-0.0377	0.1053	0.0197	0	0
0.0704	-0.0103	0.0715	0.0673	0	0
-0.0454	-0.0607	-0.0010	0.0021	0	0
-0.0200	-0.0839	0.0246	-0.0596	0	0
0.0407	-0.0190	0.0026	-0.0284	0	0
0.0333	-0.1059	0.0013	-0.0139	0	0
-0.0944	-0.0214	0.0801	-0.0511	0	0
0.0958	0.0484	0.0807	-0.0119	0	0
0.294	-0.0532	0.0129	-0.0832	0	0

- The final weights of the input bias to hidden layer ( $b_1$ )

-7.1824	0.5682	-2.4592	4.0988	2.8834
-1.0595	4.0334	3.6963	-1.4841	2.9170

- The final weights of hidden layer to output layer ( $w_i$ )

0.0370	0.3796	-0.0077	0.6752	-0.2340
0.4756	-0.8120	-0.4361	0.4333	0.3410

- Finally, the final weight of the output bias ( $b_2$ ) is 0.2104

Based on the results of network weights, other data examination conducted to predict the degree of test items validity and obtained the following results (Table III):

Table III. The experiment results some input data

% C1	% C2	% C3	% C4	% C5	% C6	Validity Score	Category
5	40	50	5	0	0	0.934	Very High
10	10	25	50	5	0	0.151	Very Low
20	30	50	0	0	0	0.240	Low
10	10	60	20	0	0	0.097	Very Low

Some examples of variations in the data provided, generated a varied level of validity anyway. It appears that the ANN work based on experience with previous data through the training process to generate the output. In this network, the system had given initial data are quite numerous and varied, will produce a different value of weighting given above, and will give different output results.

## CONCLUSION

ANN is specially designed computer programs that can be used to determine the level of the validity of the test items without using the score results from students but based on data that have been obtained in the past. With input data in the form of a percentage in the taxonomy of Anderson-Krathwohl will be known to the prediction of its validity level.

## References

- [1] Masidjo, I., 2004, Assessment of the achievement of Student Learning Outcomes in schools, 6<sup>th</sup> printing, Kanisius, Yogyakarta.
- [2] Arikunto, S., 2006, The basics of education Evaluation, Revised Edition, Bumi Aksara, Jakarta.
- [3] Oriundo, L.L. and Dallo-Antonio, E.M., 1998, *Evaluating Educational Outcomes (Tests, Measurement and Evaluation)*, Rex Book Store, Manila.
- [4] Wijaya, M., 2009, Taxonomy Bloom in Digital Era Education, <http://high-aims.blogspot.com/2009/02/taxonomy-bloom-in-digital-era.html>, accessed January 12<sup>th</sup>, 2010.
- [5] Bennyarsih, C., 2006, Korelasi Antara Pembelajaran Remedial dengan Pencapaian Tujuan Pembelajaran Mata Pelajaran PKnPS Pokok Bahasan Perjuangan Melawan Penjajah

- dan Pergerakan Nasioal pada Siswa Kelas V SD Negeri Segugus Pamuji UPK Karanglewas Semester II Tahun Pelajaran 2005/2006. *Skripsi*, Thesis FKIP UMP, Purwokerto.
- [7] Dwiningsih, Y., 2006, Analisis Sistem Evaluasi Kurikulum 2004 Beberapa SMA Swasta pada Mata Pelajaran Biologi Kelas X Tahun Pelajaran 2004/2005 di Kabupaten Banyumas, *Skripsi*, FKIP UMP, Purwokerto.
- [8] Handayani, L., 2003, Evaluasi Soal Tes Ulangan Umum Matematika SMU Kelas I Catur Wulan 3 di Kabupaten Banyumas, *Skripsi*, FKIP UMP, Purwokerto.
- [9] Hani, D.F., 2006, Analisis Butir Soal Akhir Semester Genap Kelas X Bidang Studi Biologi Kurikulum 2004 Tahun Pelajaran 2004/2005 di SMA Negeri Sumpiuh Kabupaten Banyumas, *Skripsi*, FKIP UMP, Purwokerto.
- [10] Nurhasanah, F., 2003, Evaluasi Soal Tes Matematika SLTP Kelas I Catur Wulan 3 di Kabupaten Banyumas, *Skripsi*, FKIP UMP, Purwokerto.
- [11] Purwanti, D., 2005, Upaya Evaluasi Pelaksanaan Kurikulum 1994 Melalui Analisis Butir Soal Ujian Akhir Semester Genap Bidang Studi Biologi Kelas I Tahun Pelajaran 2003/2004 pada SMA Veteran dan SMA Jendral Sudirman Purwokerto, *Skripsi*, FKIP UMP, Purwokerto.
- [12] Rahayu, D.A., 2003, Evaluasi Soal Tes Ulangan Umum Matematika SMU Kelas II Catur Wulan 3 di Kabupaten Banyumas, *Skripsi*, FKIP UMP, Purwokerto.
- [13] Sari, R.D.P., 2006, Evaluasi Kualitas Soal Ujian Akhir Semester Genap Mata Pelajaran Biologi Kelas X Tahun Pelajaran 2004/2005 di SMA Negeri 3 Purwokerto, SMA Negeri 4 Purwokerto, dan SMA Negeri Sokaraja, *Skripsi*, FKIP UMP, Purwokerto.
- [14] Susiani, E., 2005, Hubungan Antara Kedisiplinan dengan Prestasi Belajar Siswa Kelas II SMP Negeri 3 Margasari Kabupaten Tegal untuk Mata Pelajaran Ilmu Pengetahuan Sosial, *Skripsi*, FKIP UMP, Purwokerto.
- [15] Wardiningsih, N., 2004, Evaluasi Soal Tes Ulangan Umum Matematika Semester Genap Kelas II SLTP Negeri 1 Karangmoncol Purbalingga, *Skripsi*, FKIP UMP, Purwokerto.
- [16] To, Karno and Wibisono, Yudi, 2005, ANATES ONLINE untuk Tes Objektif, ver0.5 (11/04/05). <http://matematika.upi.edu/staff/yudi/anates/anates.htm>, accessed October 1<sup>st</sup> 2008.
- [17] Mustafidah, H. 2009. The development of computer software to Evaluate Test Items *National Scientific Journals "Paedagogia"* ISSN 1026-4109, Volume 10 number 2, April 2009, pp. 145-153
- [18] Munakata, T., 2008, *Fundamentals of the New Artificial Intelligence : Neural, Evolutionary, Fuzzy and More*, Second Edition, Springer-Verlag London Limited.
- [19] Kusumadewi, S. and Hartati, S., 2006, *Neuro-Fuzzy Systems: integration of Fuzzy and Neural Network*, Graha Ilmu, Yogyakarta.
- [20] Jones, M.T., 2008, *Artificial Intelligence A Systems Approach*. Infinity Science Press LLC.
- [21] Kartalopoulos, S.V., 2003, *Understanding Neural Networks and Fuzzy Logic : Basic Concepts and Applications*, Third Printing, Prentice-Hall of India, New Delhi.
- [22] Mustafidah, H. and Hartati, S., 2009. Fuzzy classification Using Backpropagation Networks (case studies of Student Achievement based on prediction of NEM, discipline, and motivation) *Proceedings of the International Seminar on the Research results in 2009* ISBN : 978-979-704-740-5, Sciences Cluster, Purwokerto.
- [23] Harjono and Aryanto, D. 2009. Application of Neural Network to predict the Learning Achievements of students *National Scientific Journals "SAINTEK"* ISSN 0852-1468, December 2009 Edition, page 19 – 30.
- [24] Suyanto, 2007, *Artificial Intelligence: Searching, Reasoning, Planning, and Learning*, Informatika, Bandung.

## PERFORMANCE ANALYSIS OF CLASSIFICATION ALGORITHM OF DATA MINING TO STUDENTS STATUS IN HIGHER EDUCATION

<sup>1,2</sup>Imam Tahyudin, <sup>1</sup>Azhari Shouni Barkah

<sup>1</sup>Department of Information System, STMIK AMIKOM Purwokerto, Indonesia

<sup>2</sup>Email: imam.tahyudin@amikompurwokerto.ac.id

### **Abstract**

*Based on BAN-PT guide in 2008, on-time graduation rate is one of the instruments of accreditation a college assessment. one of the factors that affect the level of accuracy is a graduate student status is inactive students. Case studies on STMIK AMIKOM Purwokerto showed that the accuracy reached 78.80% passed. Steps can be taken to increase the percentage of students passing the right time is to gather information from the student database. Excavation of information can be done with data mining classification. The purpose of this study was to compare several data mining classification algorithms, namely Decision Tree (DT), Naive Bayes (NB), Artificial Neural Network (ANN), Support Vector Machine (SVM) and Logistic Regression (LR) with a basic evaluation of cross validation and T-Test. The method used is the method of comparison. Based on a comparison of performance and test T, SVM algorithm is the most appropriate algorithm used for prediction in a timely graduation. DT algorithm prediction accuracy rate (98.02%) with the excellent classification category. In addition, based on the results of T-Test is very dominant DT algorithm compared with other algorithms.*

**Keywords:** algorithms, classification, data mining, student, graduate, right.

### **1. INTRODUCTION**

College students need to detect behaviors that tend to pass ill-timed one factor is inactive students. This is important because it influences the quality of a college assessment. Based on the assessment instrument matrix accreditation of the National Accreditation Board for Higher Education (BAN-PT) [1] that the percentage of students who graduate on time is one element of accreditation of a study program.

STMIK AMIKOM Purwokerto is one of the largest universities in Central Java which has 3,490 students. Based on data from the administrative and academic (BAAK) in 2013 showed that the graduation rate of students in a timely STMIK AMIKOM Purwokerto reached 78.80%. Efforts

should be made to increase the percentage of students passing the right time is to gather information from a database stored in BAAK STMIK AMIKOM Navan. Through the database can be extracted valuable information for consideration to improve on-time graduation. One method of data mining that can be used is the classification method [3], [4], [5].

There are many classification algorithms that can be used as Logistic Regression algorithm, decision tree, naive Bayes, neural networks, and support vector machine (SVM) [13], [14]. The research that has been conducted by previous researchers who conducted them by Madhu S.Shukla and Kirit R. Rathod [12] studied the comparison algorithm naive Bayes, Hoefding tree, and CVDFT. Software used is MOA (Massive Online Analysis). The research results show that the algorithm is an algorithm that best CVDFT.

Research conducted by Vahid Alizadeh Sahzabi and Azuraliza Abu Bakr [2] on a comparison of several data mining classification algorithms, namely decision tree (J48 and LMT), Bayes algorithm (Naive Bayes and Bayesian networks), Classification neural network (MLP = multi-layer perceptron, RBF = radial base function), and the method of Rough Sets. The data used is a blood test that caused liver disorders and alcoholic beverages.

Further research conducted by Khafiizh Hastuti [6] on the comparison of classification algorithms, namely Logistic Regression algorithm, decision tree, naive Bayes, neural network, with an evaluation tool that is cross validation, confusion matrix, ROC Curve and T-Test. The sample used 3861 students study program Informatics, Information Systems and Visual Communication Design UDINUS Semarang. The results obtained are Logistic Regression algorithm is an algorithm which is the most dominant right but its accuracy is the lowest value. Further research conducted by P. Nancy and R. Geetha Ramani [8] about the comparison of several methods of data mining classification Rnd Tree namely, ID3, K-NN, C-RT, CS-CRT, C.45 and CS-MC4. In this study sought a method that produces the smallest error which



shows the effectiveness of the algorithm in solving the social network the data. The research results show that the algorithm Rnd Tree has the smallest error rate. Further research conducted by Milan Kumari, Sunila Godara [7] on the comparison of data mining classification algorithms, namely RIPPER classifier, decision tree, artificial neural network (ANN), support vector machine (SVM). Some algorithms will be compared from several aspects including sensitivity levels, specifications, accuracy, the error rate, the level of right or wrong. The data used is the data about cardiovascular disease. The result is the SVM algorithm is an algorithm that produces the smallest error and Tertiary greatest accuracy. Further research conducted by Neslihan Dogan and Saturn Tanrikulu [15] about the comparison of several data mining algorithms, namely CHAID, MLP, Logistics, airs and Naive Bayesian were applied to the data set. Resulting conclusion that the best model used for prediction is regression model. Further research conducted by Silvia Marselina Suhartinah and Ernastuti [10] on the application of

data mining to predict graduation using Naive Bayes and C4.5 algorithms. The result is an algorithm C4.5 has a greater degree of accuracy than Naive Bayes.

Based on the above researchers are interested in comparing several algorithms generated in previous studies resulted in the greatest degree of accuracy, namely Decision Tree (DT), Naive Bayes (NB), Artificial Neural Network (ANN), Support Vector Machine (SVM) and Logistic Regression (LR) on the basis of cross validation and evaluation of the T-Test.

## 2. RESEARCH METHOD

This research method uses comparative research methods. According to Nazir [9] is a kind of comparative study descriptive study seeking fundamental answers about the result, by analyzing the factors that cause the occurrence or the emergence of a particular phenomenon. Step-by-step research process that will be carried out as shown in Figure 2.1.

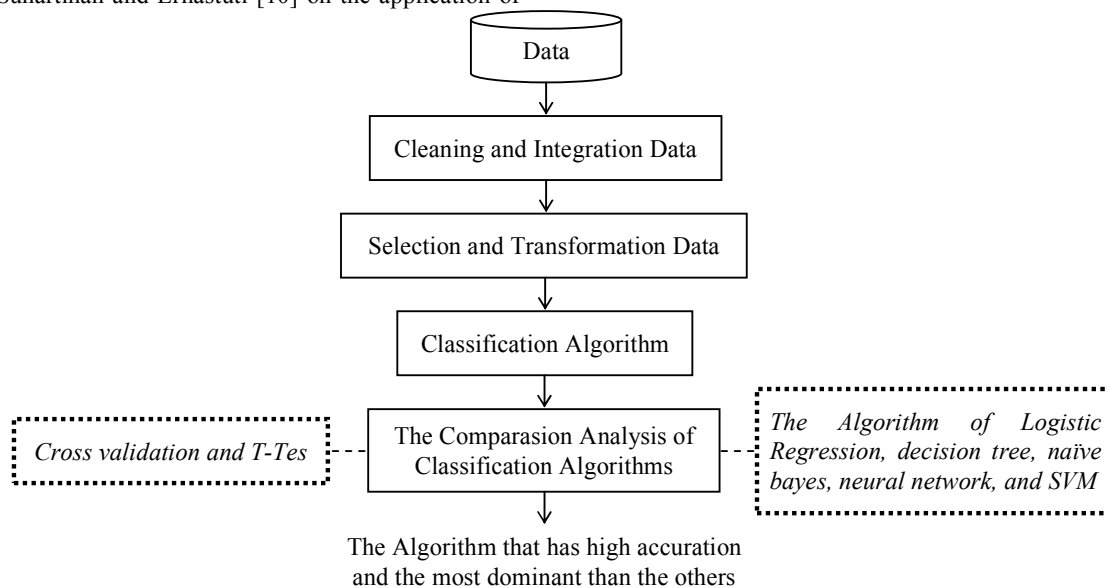


Figure 2.1. Flowchart of study steps

### Data Collection Method

Based on the above steps the data used are secondary data. Data obtained from the Administrative and Academic (BAAK) STMIK AMIKOM Purwokerto is a master student biographical data, ie personal data when first registration year 2005-2009 as many as 1,286 students. Supporting data in this thesis was obtained from the literature such as journals, reference

books, proceedings and so forth. Attribute data is used as shown in Table 2.1.

Table 2.1. Data attributes used

Atribut	Explanation
NIM	Id
Status Mahasiswa	Label
PT Code	063065 = STMIK AMIKOM Purwokerto
Departmen Code	57201 = Information system 55201 = Computer engineering

Semester year	2005.1 = odd semester in 2005 2005.2 = even semester in 2005 Etc
---------------	--

### Methods of Data Analysis

In this study the data mining methods used for the analysis of data is the method of classification. Classification method is a method to predict the status of students STMIK AMIKOM Navan inactive. The algorithm technique used in classification methods ie Logistic Regression algorithm, decision tree, naive Bayes, neural network and SVM. Some of these algorithms with the comparative evaluation tool that is cross validation, confusion matrix, ROC Curve and T-Test.

## 3. RESULT AND ANALYSIS

### Performance Analysis Based Confusion Matrix Evaluation

Output validation process table Confusion Matrix obtained from DT algorithm as follows:

Tabel 3.1. Output *confusion matrix* DT algoritma

accuracy: 98.02% +/- 0.90% (mikro: 98.01%)			
	true K	true N	class precision
pred. K	8	3	72.73%
pred. N	14	830	98.34%
class recall	36.36%	99.64%	

The table is based on the results of the evaluation showed that the classification accuracy rate of 98.02% DT algorithm.

Output validation process table Confusion Matrix obtained from NB algorithm as follows:

Tabel 3.2. Output *confusion matrix* NB algorithm

accuracy: 97.31% +/- 0.74% (mikro: 97.31%)			
	true K	true N	class precision
pred. K	1	2	33.33%
pred. N	21	831	97.54%
class recall	4.55%	99.76%	

The table is based on the results of the evaluation showed that the classification accuracy rate of 97.31% NB algorithm.

Output validation process table Confusion Matrix obtained from ANN algorithm is as follows:

Tabel 3.3. Output *confusion matrix* ANN algoritma

accuracy: 97.90% +/- 1.14% (mikro: 97.89%)			
	true K	true N	class precision
pred. K	8	4	66.67%
pred. N	14	829	98.34%
class recall	36.36%	99.52%	

The table is based on the results of the evaluation showed that the classification accuracy rate of 97.90% ANN algorithm.

Output validation process table Confusion Matrix obtained from SVM algorithm as follows:

Table 3.4. Confusion matrix output SVM algorithm

accuracy: 71.82% +/- 3.16% (mikro: 71.81%)			
	true K	true N	class precision
pred. K	9	228	3.80%
pred. N	13	605	97.90%
class recall	40.91%	72.63%	

The table is based on the results of the evaluation showed that the classification accuracy rate of 71.82% SVM algorithm.

Output validation process table Confusion Matrix obtained from LR algorithm as follows:

Table 3.5. Output confusion matrix LR algorithm

accuracy: 65.85% +/- 6.98% (mikro: 65.85%)			
	true K	true N	class precision
pred. K	9	279	3.12%
pred. N	13	554	97.71%
class recall	40.91%	66.51%	

The table is based on the results of the evaluation showed that the classification accuracy rate of 65.85% LR algorithm.

### Performance Analysis Based on The Value of The ROC (Receiver Operating Characteristic) or AUC (Area Under the Curve)

Output ROC Curve DT algorithm shown in Figure 3.1. the following:

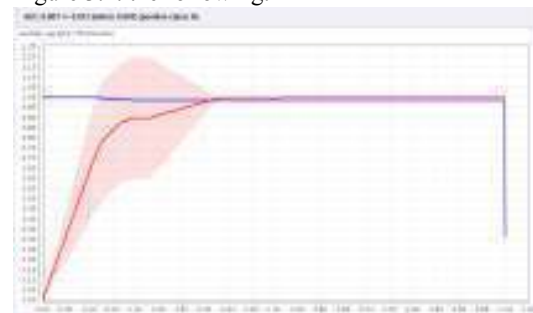


Figure 3.1. Output AUC DT algorithm

Based on the images obtained AUC value of 0.901. These results indicate that the diagnostic classification using DT algorithms including classification categories good (excellent Classification).

Output ROC Curve or AUC NB algorithm shown in Figure 3.2. the following:



Figure 3.2. Output AUC NB algorithm

Based on the images obtained AUC value of 0.885. These results indicate that the diagnostic classification algorithms including classification categories either NB (good Classification).

Output ROC Curve or AUC ANN algorithm shown in Figure 3.3. the following:



Figure 3.3. Output AUC ANN algorithm

Based on the images obtained AUC value of 0.937. These results indicate that the diagnostic classification using ANN algorithms including classification categories is very good (excellent Classification).

Output ROC Curve or AUC SVM algorithm shown in Figure 3.4. the following:

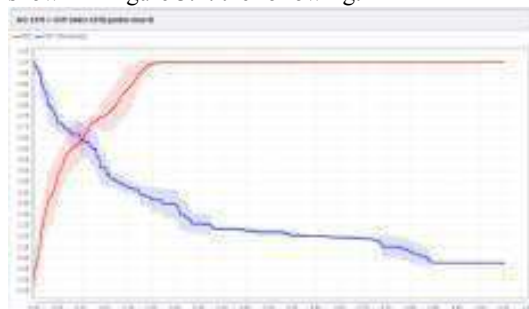


Figure 3.4. Output AUC SVM algorithm

Based on the images obtained AUC value of 0.915. These results indicate that the diagnostic classification algorithms including SVM classification categories is very good (excellent Classification).

Output ROC Curve or AUC LR algorithm shown in Figure 3.5. the following:

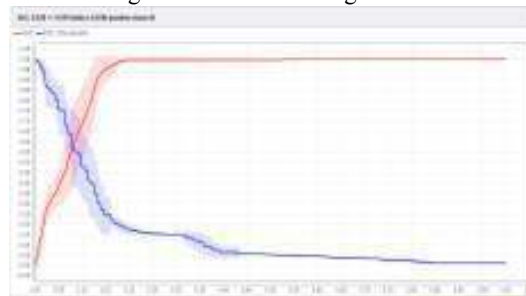


Figure 3.5. Output AUC LR algorithm

Based on the images obtained AUC value of 0.928. These results indicate that the diagnostic classification using ANN algorithms including classification categories is very good (excellent Classification).

### Output T-test

To determine the best algorithm is used to predict the exact time student graduation rates using a statistical t-test. Based on the results of t-test results obtained matrix t-test as follows:

Table 3.6. Table Matrix T-test

	DT	NB	ANN	SVM	LR
DT		<b>0,00</b>	<b>0,00</b>	<b>0,00</b>	<b>0,00</b>
NB	<b>0,00</b>		0,76	0,63	<b>0,04</b>
ANN	<b>0,00</b>	0,76		<b>0,01</b>	0,52
SVM	<b>0,00</b>	0,63	<b>0,01</b>		0,81
LR	<b>0,00</b>	<b>0,04</b>	0,52	0,81	

Based on Table 3.6. algorithm is the most dominant among the other algorithms are algorithms Decision Tree (DT) it can be seen the value of t-calculated (0.00) are all less than t-table (0.05).

### Performance Comparison of Data Mining Classification Algorithms

Based on the results obtained classification accuracy rate performance results of each algorithm to predict graduation on time as shown in Table 3.7.

Table 3.7. Comparison of the performance of Data Mining Classification Algorithms

	Algoritma DT	Algoritma NB	Algoritma ANN	Algoritma SVM	Algoritma LR
<b>Accuracy</b>	98,02%	97,31%	97,90%	71,82%	65,85%
<b>AUC</b>	0,901 (Excellent clasification)	0,885 (Good clasification)	0,937 (excellent clasification)	0,915 (excellent clasification)	0,928 (excellent clasification)
<b>T-Test</b>	The most dominant	Dominant	Dominant	Dominant	Dominant

Based on the comparison table 3.7. algorithm is recommended for use in predicting student status is STMIK AMIKOM Purwokerto Decision Tree algorithm (DT) because they have the greatest predictive accuracy (98.02%), has a very good category and is dominant among the other algorithms.

#### 4. CONCLUSION

Based on the comparison results show that the algorithm DT is the best algorithm for predicting graduation rates of students with 98.02% accuracy rate and accuracy of 0.901 means the value of the ROC Curve Classification excellent category. Suggestions for subsequent research to try other classification algorithms such as K-Nearest Neighbourhood, ID3, CHAID and others. It is also necessary to develop the type of evaluation used as delong Pearson.

#### References

- [1] Anonim, 2008. The 4 th Book of Assessment Instrument Matrix Accreditation Program National Accreditation Board for Higher Education.
- [2] Barnaghi, Peiman Mamani, sahzabi vahid alizadeh, abu bakar azuraliza, 2012. "Comparative Study for Various Methods of Classification," *International conference and computer network (ICICN 2012). IPCSIT vol. 27 (2012) ©(2012) IACSIT*
- [3] Dunham, M.H., 2002. "Data mining," *Introductory and Advanced Topics*. Prentice Hall.
- [4] Gorunescu, F. (2011). "Data Mining Concept Model and Techniques," Berlin: *Springer*. ISBN 978-3-642-19720-8
- [5] Han, J., & Kamber, M. (2006). "Data Mining Concept and Tehniques," San Fransisco: *Morgan Kauffman*. ISBN 13: 978-1-55860-901-3
- [6] Hastuti, Khafiizh. 2012. "Comparative Analysis of Classification Algorithm for Data Mining Prediction of Non-Active Students," *Seminar Nasional Applied Information and Communication 2012 (SEMANTIK 2012)* Semarang, June 23, 2012.
- [7] Kumari, Milan., Godara., Sunila. 2011. "Comparative Study of Data Mining Clasification Methods in Cardiovascular Diseases Prediction," *IJCST Vol 2. Issue 2, June 2011. ISSN : 2229 – 4333(Print) – 0976 – 8491 (online)*.
- [8] Nancy, P., Ramani, R. Geetha. 2011. "A Comparison on Performance of Data Mining Algorithms in Clasification of Social Network Data," *International Journal of computer Applications (0975 – 8887) Vol. 32 No. 8 October 2011*.
- [9] Nazir, Mohammad., 2005, "The Reseach Method," *Ghalia*, Indonesia
- [10] Suhartinah, S. M., Ernastuti. 2010. "Graduation Prediction of Guna Dharma University Students Using Algorithm Naive Bayes and C4.5 Algorithm," *Jurnal Magister Sistem Informasi*. Universitas Guna Dharma. Jakarta.
- [11] Sharma, Aman Kumar., Sahni, Suruchi. 2011. "A Comparative Study of Clasification Algorithms for Spam Email Data Analysis," *International Journal On Computer Science and Engineering (IJCSE). ISSN : 0975 – 3397 Vol. 3 No. 5 may 2011*
- [12] Shukla, Madhu S., Rathod, Kirit R. 2013. "Stream Data Mining and Comparative Study Of Clasification Algorithms," *International journal of engineering research and applications (IJERA) ISSN : 2248 – 9622 Vol. 3, Issue 1, January – February 2013, pp. 163-168*
- [13] Vercellis, Carlo. 2009. "Business Intelligence: Data Mining and Optimization for Decision Making," United Kingdom: *John Willey & Son*.
- [14] Witten, Ian, H; Eibe, Frank; Hall, A.M. 2011. "Data Mining : Practical Machine Learning Tools and Technique," 3rd ed., Asma Sthepan and Burlington, Eds. United States of America, *Morgan Kaufman*.

- [15] Neslihan Dogan, Zuhail Tanrikulu. 2010. "A comparative framework for evaluating classification algorithms," *Proceedings of The World Congress on Engineering 2010 Vol. I WCE 2010, June 30 – July 2, 2010, London, U.K.*

## Frequency and Voltage Correction in Single Machine System Using Linear Quadratic Gaussian Feedback

Farid Dwi M.<sup>(1)</sup>, Ratih Mar'atus S.<sup>(2)</sup>, Aji Akbar F.<sup>(3)</sup>, Ribka Stephani<sup>(4)</sup>, Imam Robandi<sup>(5)</sup>

<sup>(1,3,5)</sup> Tenth of November Institute of Technology (ITS)

<sup>(3)</sup> Christian of Petra University, Surabaya

Kampus ITS Sukolilo, Surabaya 60111

E-mail: [farid13@mhs.ee.its.ac.id](mailto:farid13@mhs.ee.its.ac.id)

### Abstract

*Disturbance on SMIB can be transient or dynamic disturbance. Dynamical nature disturbance resulted in the system being disturbance and unstable. To solve this problem need to know the behavior of dynamical systems and control system. To overcome the dynamical systems disturbance on power system voltage and frequency improvements made due to changes in the load <sup>[2]</sup>. Improvement of frequency and voltage in power system is carried out by means of Linear Quadratic feedback add a Gaussian (LQG). By adding feedback LQG system will provide voltage and frequency response to be faster and more stable.*

**Keywords:** SMIB, LQG

### INTRODUCTION

The dynamic disturbance on power system is an issue that is very important and interesting to research. The presence of interference on power system caused by load change frequently. This has an impact on the performance of electric power system, that system's performance becomes less good or could even become unstable.

Has many methods are used to improve the performance of dynamic on the power system. The

method which will be discussed in this paper is to add Linear Quadratic Gaussian feedback on this side of the turbine and the excitation. Feedback LQG on the side of the turbine and the excitation is aimed at controlling the frequency and voltage at the same time so that the system becomes more quickly to achieve stability.

### MODEL SYSTEM

#### A. Electric Power Net Linear Model single engine

In this section will be applied to electric power network dynamic model single engine turbine system covering and their settings (governor), synchronous generator excitation systems, and static load. In the form of block diagrams, model linear system net power single engine shown in Figure 1.

From Figure 1 system equation of State can be formed as follows:

$$\dot{x}(t) = Ax(t) + Bu(t) + \Gamma\omega(t)$$

$$y(t) = Cx(t) + v(t)$$

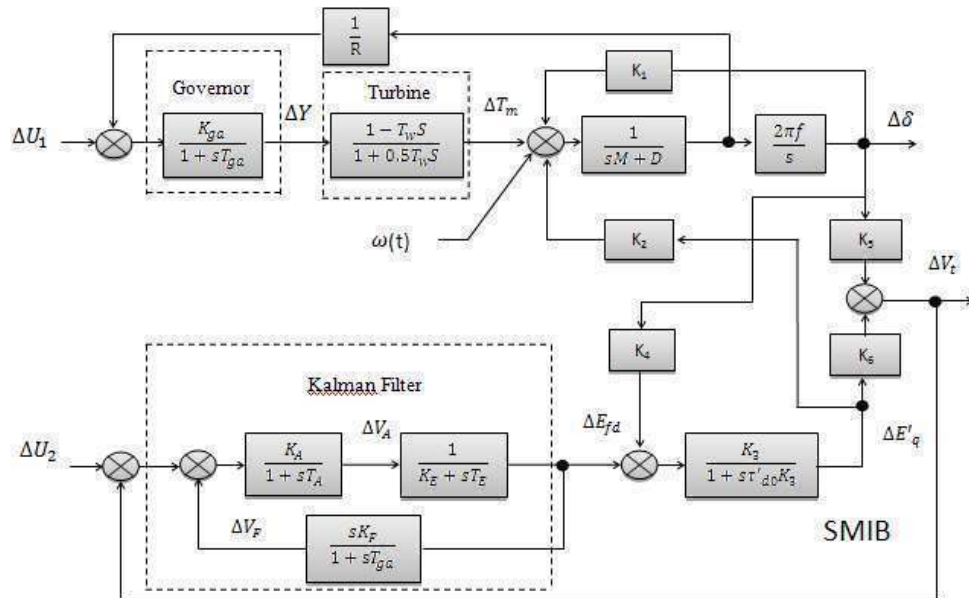


Figure 1 Single Engine Model All<sup>[2]</sup>

$A$  : Matrix systems  
 $B$  : Matrix input  
 $C$  : Matrix metering  
 $\Gamma$  : Matrix disturbance  
 $x(t)$  : State Variables  
 $u(t)$  : Input Variables  
 $\omega(t)$  : Variables Vector Disturbance (White noise)  
 $y(t)$  : Output Variables  
 $v(t)$  : Disturbance Measurement Vector  
 $\Delta Y$  : Changes the level of the valve  
 $\Delta T_m$  : Mechanical torque changes  
 $\Delta \omega$  : Change of angular velocity  
 $\Delta \delta$  : Change the angle of the rotor  
 $\Delta V_A$  : The change in voltage towards the excitation  
 $\Delta E_{fd}$  : Change the voltage field  
 $\Delta E'_q$  : The change of voltage generator  
 $\Delta V_F$  : Voltage changes in the direction of excitation after filtered

#### B. Linear Quadratic Gaussian (LQG) Feedback

Feedback LQG is aimed to optimize system performance. On paper this feedback LQG is devoted on optimization of frequency and voltage on the side of the turbine and the excitation. Feedback LQG control described by the Generator that produces output that is sent to the 8 equipment through the help of the sensor as shown in Figure 2. After the output signal from the generator received by equipment then the signal will be processed and fed back to the system of control signals that are on the side of the turbine and the excitation.

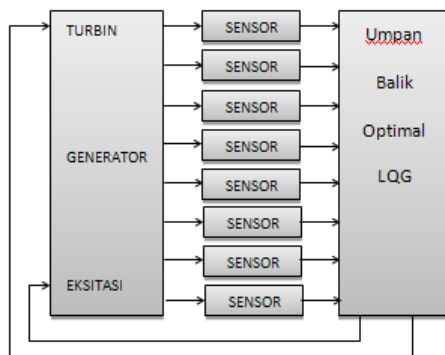


Figure 2. Application of LQG Feedback System on a Single Machine power system <sup>[2]</sup>

The feedback signal on the side of the turbine and the excitation signal frequency to correct the frequency signal and voltage disturbance because dynamical systems disturbance. By using feedback on the turbine side and excitation will hopefully be

able to improve the system of dynamical system disturbance.

#### C. Block Diagram System

With a single engine models merging whole and given LQG feedback, the system as a whole will be simulated using Matlab are shown in Figure 3.

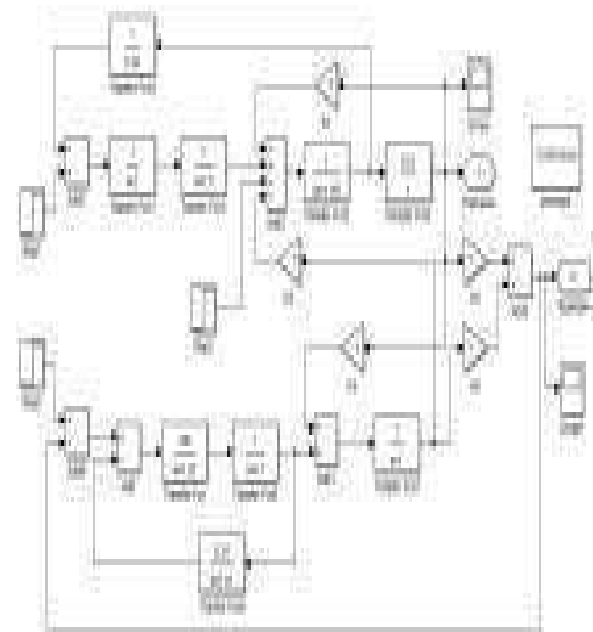


Figure 3 Single Engine Models using LQG Feedback

In Figure 3 the indicated block diagram of the overall system is simulated using matlab. The complete system using parameters have been determined. By adding feedback LQG which aims to improve the frequency response and voltage. By using preliminary data on the results of the calculation and simulation of voltage and frequency on the side would be a feedback kesisi or enter the turbine and the excitation, after which it will be processed again with stabilizing and speeding up the response frequency and voltage. This process will be iterated and the result of the output voltage and frequency will continue to be routed using the inverse feedback LQG to found the result error close to zero as well as voltage and frequency response much faster.

#### RESULT of SIMULATION and ANALYSIS

Before simulation stage required checking beforehand whether the system discussed in this dipaper can be controlled, monitored, and

commonly abbreviated stable with COS (Controlability Stability Observability). From the block diagram with Governor SMIB obtained state space equation as below:

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \\ \dot{x}_4 \\ \dot{x}_5 \\ \dot{x}_6 \\ \dot{x}_7 \\ \dot{x}_8 \end{bmatrix} = \begin{bmatrix} \Delta Y \\ \Delta T_m \\ \Delta \omega \\ \Delta V_A \\ \Delta E_{fd} \\ \Delta E'_q \\ \Delta V_F \end{bmatrix} = \begin{bmatrix} a_{1,1} & \dots & a_{1,8} \\ \vdots & \ddots & \vdots \\ a_{8,1} & \dots & a_{8,8} \end{bmatrix} \begin{bmatrix} \Delta Y \\ \Delta T_m \\ \Delta \omega \\ \Delta \delta \\ \Delta V_A \\ \Delta E_{fd} \\ \Delta E'_q \\ \Delta V_F \end{bmatrix} + \begin{bmatrix} b_{1,1} & b_{1,2} \\ \vdots & \vdots \\ b_{8,1} & b_{8,8} \end{bmatrix} \begin{bmatrix} \Delta U_1 \\ \Delta U_2 \end{bmatrix} + \begin{bmatrix} \Gamma_{1,1} \\ \vdots \\ \Gamma_{8,1} \end{bmatrix}$$

The measurement matrix equation is:

$$\begin{bmatrix} y_1 \\ \vdots \\ y_8 \end{bmatrix} = \begin{bmatrix} \Delta Y \\ \Delta T_m \\ \Delta \omega \\ \Delta V_A \\ \Delta E_{fd} \\ \Delta E'_q \\ \Delta V_F \end{bmatrix} = \begin{bmatrix} c_{1,1} & \dots & c_{1,8} \\ \vdots & \ddots & \vdots \\ c_{8,1} & \dots & c_{8,8} \end{bmatrix} \begin{bmatrix} \Delta Y \\ \Delta T_m \\ \Delta \omega \\ \Delta \delta \\ \Delta V_A \\ \Delta E_{fd} \\ \Delta E'_q \\ \Delta V_F \end{bmatrix} + \begin{bmatrix} v_1 \\ \vdots \\ v_8 \end{bmatrix}$$

The system above is said to be controlled if the matrix below has rank  $P = n$ .

$$P = [B : AB : A^2B : \dots : A^{(n-1)}B]$$

Through the formula above is obtained that rank =  $n$  then the system is said to be controllable (Controlable)

he system above is said to be observable if the matrix below has rank  $P = n$

$$P = [C^T : A^T C^T : (A^T)^2 C^T : \dots : C^T (A^{n-1})^T C^T]$$

Through the above formula is obtained that rank =  $n$  then the system is said to be observable (Observable)

The system above is said to be stable if the value of the matrix  $A$  is the eigenvalue is negative.

With the above equation eigenvalue calculation on obtained a negative eigenvalue, so this system can already said to be stable.

On the simulation of combined Block Diagram SMIB and Governor as in Figure 3 by using matlab by not using feedback LQG wave response results obtained feedback LQG as in Figure 4 and using the feedback LQG obtained wave results as in Figure 5.

On this paper will be conducted observation of frequency response and voltage before and after using the feedback LQG.

#### A. Change The Frequency Response

To test the stability of the system is then given ganguan in the form of white noise (a vector variable ganguan) signal step-shaped  $w(t)$ .

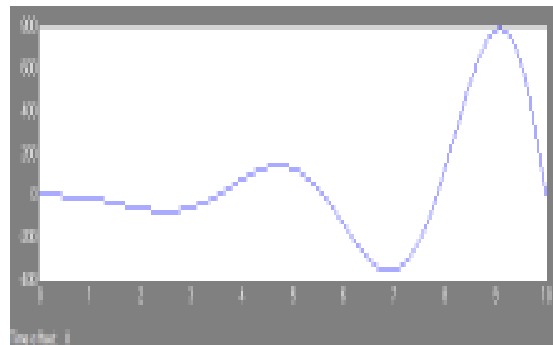


Figure 4. Response frequency changes before given Feedback LQG

Generated response Figure 4 frequency response obtained by the less well due the oscillations too big before reaching the desired condition.

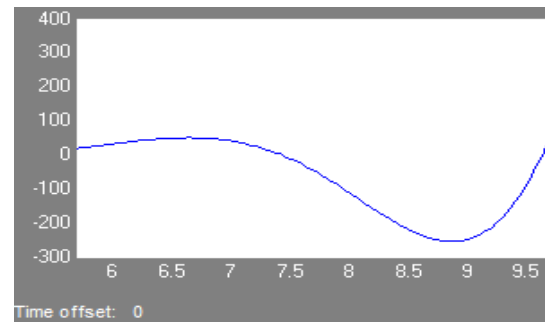


Figure 5. Change the frequency response after being given Feedback LQG

After given Feedback LQG and PID controller brings much better results than ever before. From



Figure 5 response generated waves with oscillations that are much smaller than before.

#### B. The Voltage Changes In Response

In addition to the observation of frequency response done also observations on the response of voltage as shown in Figure 6 and Figure 7.

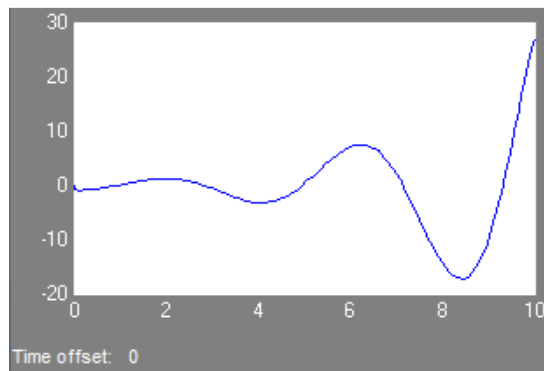


Figure 6. Voltage changes before the response is given Feedback LQG

Figure 6 generated response obtained response than either the oscillations due too big before reaching the desired condition.

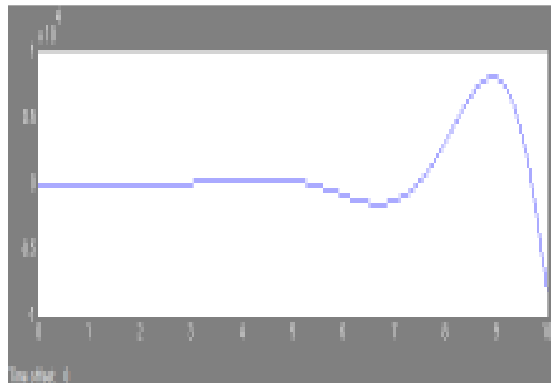


Figure 7. Voltage changes after the response is given Feedback LQG

After being given Feedback LQG and PID controller brings much better results than ever before. From Figure 7 is produced by the oscillation wave response is much less than before.

#### CONCLUSION

Simulation results from the data and analysis that has been done, then it can be concluded that:

1. the addition of feedback LQG proved able to improve response frequency and voltage and speed up the response time of the transient State towards a State of steady state.
2. Additional feedback on the turbine side and side affects results proved very excitation response frequency and voltage waves are generated.

#### References

- [1] Sigurd, Skogestad, "*Multivariabel Feedback Control*", Second Edition, John Wiley & Sons, England, 1996.
- [2] Robandi, Imam. "*Desain Sistem Tenaga Modern*", ANDI, Yogyakarta.2006.
- [3] Robandi, Imam. "*Modern Power Sistem Control*". ANDI.yogyakarta.2009.

## ANALYSIS CONTROLLABILITY, OBSERVABILITY, STABILITY IN SMIB BY GOVERNOR

**Mei Adetya Praja, Abil Huda, Yoni Wicaksono, and Imam Robandi**  
Department of Electrical Engineering-Faculty of Industrial Technology,  
Institute of Technology Surabaya (ITS), Keputih-Sukolilo, Surabaya 60111

### Abstract

Excitation System on a Single Machine Infinite Bus (SMIB) influence on the power system. This paper will discuss the analysis controllability, observability and stability on a Single Machine Infinite Bus (SMIB) with the Governor. From the experimental results showed that the system can be in control, but it can not be observed and unstable.

**Keywords:** Excitation System, Single Machine Infinite Bus, Value Eigenvalue

### INTRODUCTION

State Space is the mathematical modeling of a plant or system used to control a system problem resolution.

To solve the problem of dynamic control systems, information systems must be obtained. Before performing stability analysis, needs analysis and observation and stability control.

SMIB is a system that channels the power of the machine to infinite bus (infinite bus). Governor is a device which controls the speed (speed) and power output (power) based on power-frequency characteristics. A system is said to be stable if the value eigenvalue located to the left of the imaginary axis. If the eigenvalues on the right system unstable.

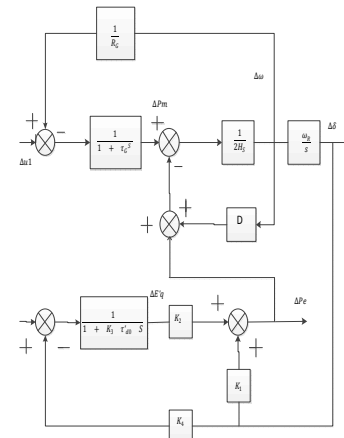


Figure 1. Block diagram of SMIB system with Governor

The method is simple system

$$\dot{x} = Ax + Bu$$

$$y = Cx$$

$x$  = matrix system state variables ( $n \times 1$ )

$u$  = matrix system input variables ( $r \times 1$ )

$y$  = matrix variable output ( $m \times 1$ )

$A$  = system matrix ( $n \times n$ )

$B$  = matrix ( $n \times r$ )

$C$  = Measurement matrix ( $m \times n$ )

### Controllability

$$P = [B : AB : A^2B : \dots : A^{(n-1)}B]$$

The system can be controlled if the matrix Phasrank =  $n$ .

### Observability

$$P = [C^T : A^T C^T : (A^T)^2 C^T : \dots : (A^T)^{(n-1)} C^T]$$

### Stability

Characteristics eigenvalues

$$a_0\lambda^n + a_1\lambda^{n-1} + a_2\lambda^{n-2} + \dots + a_{n-1}\lambda + a_n = 0$$

The system is stable if the roots of the characteristic equation is the imaginary axis on the left.

Matrix computations using MATLAB software.

### RESULTS AND ANALYSIS

State spacematrices SMIB with a governor:

$$\begin{bmatrix} \Delta\delta \\ \Delta\omega \\ \Delta E_q \\ \Delta P_m \end{bmatrix} = \begin{bmatrix} 0 & \omega_r & 0 & 0 \\ -\frac{K_1}{2H} & -\frac{D}{2H} & -\frac{K_2}{2H} & \frac{1}{2H} \\ -\frac{K_4}{\tau_{d0}} & 0 & -\frac{1}{K_3 \tau_{d0}} & 0 \\ 0 & -\frac{1}{\tau_G R_G} & 0 & -\frac{1}{\tau_G} \end{bmatrix} \begin{bmatrix} \Delta\delta \\ \Delta\omega \\ \Delta E_q \\ \Delta P_m \end{bmatrix} + \begin{bmatrix} 0 & 0 \\ 0 & 0 \\ 0 & \frac{1}{\tau_{d0}} \\ \frac{1}{\tau_G} & 0 \end{bmatrix} \begin{bmatrix} \Delta u_1 \\ \Delta E_{FD} \end{bmatrix}$$

$$\begin{aligned} \omega_r &= 6, K_2 = 4 \\ K_1 &= 8, K_3 = 2 \\ H &= 2, R_G = 2, \\ \tau_{d0}' &= 2, \tau_G = 4, \\ D &= 4, K_4 = 2 \end{aligned}$$

```
>> A=[0 6 0 0;-8/4 -4/4 -4/4 1/4;
      -2/2 0 1/4 0; 0 -1/8 0 -1/4];
>> B=[0 0;0 0;0 1/2;1/4 0];
>> C=[2 3 4 5];
```

#### Controllable:

n=4, then:

$$P = [B : AB : A^2B : A^3B]$$

```
>> rank(P)
ans =
4
```

Rank P = 4 then the system Controllable

#### Observable:

n=4, then:

$$P = [C^T : A^T C^T : A^{T^2} C^T : A^{T^3} C^T]$$

```
>> rank(P)
ans =
3
```

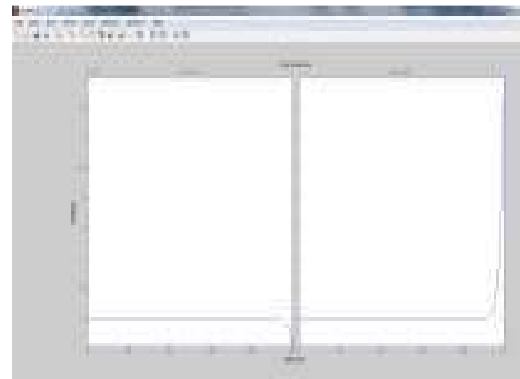
RankP=3then the systemcan not beobserved

### Stability:

```
>> eig (A)
```

```
ans =
-0.7437 + 3.4758i
-0.7437 - 3.4758i
0.2374
-0.2500
```

Unit Step Response Plot results using MATLAB



Eigenvalues of the value above which there is a value to the right of the imaginary axis located so that the system is unstable.

### CONCLUSION

After analyzing COS (controlability, observability and Stability) SMIB with Governor with these parameters it can be concluded that the system can be in control, but it can not be observed and unstable.

### Reference

- [1] Imam Robandi, Modern Power System Control: Design, Analysis & Controls Power Solutions, ANDI Publisher, 2006.
- [2] Katsuhiko Ogata, Discrete Time Control Systems 2nd Edition.
- [3] Katsuhiko Ogata, State Space Analysis of Control Systems, Prentice Hall, Upper Saddle River, New Jersey, 2002.

## ANALYSIS OF MYCROHYDRO POWER PLANT SYSTEM USING COS

**Riski Cahya Anugrerah Haebibi<sup>(1)</sup>, Ario P.H<sup>(2)</sup>, Akhmad Ramadhani<sup>(3)</sup>,  
Hermansyah<sup>(4)</sup>, Imam Robandi<sup>(5)</sup>**

Electrical Engineering Department-FTI, Institut Teknologi Sepuluh Nopember  
ITS, Keputih-Sukolilo, Surabaya - 60111, Email : rc.elits.051@gmail.com

### Abstract

Hydroelectricity is a process by which a change in the mechanical energy into electrical energy. In the process of the turbine is rotated by hydroelectric power will produce torque from the torque will be in couple with the shaft of the generator. With the couple between the shaft generator and turbine shaft torque will result in the transfer of mechanical energy from the turbine to the electrical energy generator. In electric power system, expenses incurred by the generator at any time is always changing with time. Therefore we need the Power System Stabilizer (PSS), which serves to control the load changes that always happen all the time. Before installing the control element that serves to regulate the frequency and voltage of the first generation system is necessary to analyze the COS or called by methods Controllability, observability and Stability of the hydroelectric generating system.

**Keywords:** Controllability, Observability, Stability

### INTRODUCTION

The main purpose of the analysis using COS method is to determine the characteristics of hydroelectricity systems. Before analyzing the COS method or by a method called Controllability, Observability and Stability of the hydroelectric generating system. The blocks in the diagram existing hydropower plants are transformed into state space. General state space equations are formed from the blocks diagram of hydroelectricity  $\dot{\mathbf{X}} = \mathbf{Ax} + \mathbf{Bu}$ . The notation  $\mathbf{x}$  is the state variable,  $\mathbf{u}$  is the control signal,  $\mathbf{A}$  is the system matrix and  $\mathbf{B}$  is a matrix of control. After changing the blocks diagram of hydroelectricity systems into the equation then the next state space analysis is hydroelectric power generation system using COS method is Controllability, Observability and Stability.

### THEORY

Before performing the installation of control equipment such as Power System Stabilizer analyzed COS :

#### 2.1. Analysis Controllability

Controllability analysis is used to see the characteristics of the plant control can be done or not. This value is derived from the multiplication of the matrix ranking system matrix is a matrix  $A$  by matrix  $B$  is the control matrix. A plant can be controlled if the value of the ranking of the multiplication of the matrix  $A$  by matrix  $B$  that has the same order with the ranking matrix.

#### 2.2. Analysis Observability

Observability analysis is to determine whether the condition of a plant can be made an observation or not. This value is obtained from the value of the ranking matrix multiplication result of the matrix  $A$  by matrix  $C$  (identity matrix  $A$ ). A plant is said to be observable if the matrix is equal to the value of the ranking order of the matrix.

#### 2.3. Analysis Stability

Analysis of the stability of the value obtained from the eigenvalues of the matrix  $A$ . If the value of all real-valued eigenvalues or all imaginary eigenvalues worth the value of the plant is stable.

### MYCROHYDROPOWER PLANT SYSTEM

In general, hydroelectric power generation system can be modeled in the form of a block diagram as follows :

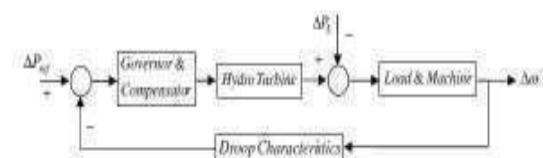


Figure 1. Block Diagram Hydropower

Here are the parameters of each hydroelectric power plant equipments :

$$\begin{aligned} \text{Governor} &= \frac{1}{1 + T_g s} \\ \text{Hydro turbine} &= \frac{1 - T_w s}{1 + 0.5 T_w s} \\ \text{Load and Machine} &= \frac{1}{2Hs + D} \\ \text{Droop Characteristics} &= \frac{1}{R_p} \end{aligned}$$

Values can be substituted into the equation above block diagram becomes :

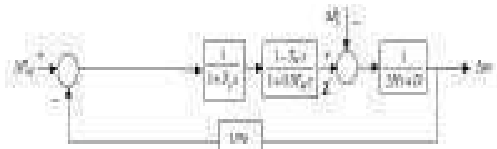


Figure 2. Block Diagram of Hydropower That Has Entered Its Parameters

Data of other parameters can be entered prior to simulation and analysis:

$$\begin{aligned} T_g &= 0.1 \quad (\text{Response speed governor}) \\ T_w &= 0.1 \quad (\text{Response speed of the water turbine}) \\ H &= 2 \quad (\text{Moment of Inertia Generator}) \\ D &= 1 \quad (\text{Damping of Generator}) \\ R_p &= 0.25 \quad (\text{Characteristics of Speed Droop}) \end{aligned}$$

#### ANALYSIS CONTROLLABILITY, OBSERVABILITY AND STABILITY

In the analysis of the system using COS impact can be seen when the system got the instantaneous load changes that will occur an influence on the frequency response that occurs in hydropower generation. COS method is used as an initial step to look at the characteristics of hydroelectricity systems that exist.

Data on get converted into the state space equation form as follows :

$$\begin{bmatrix} \Delta\omega' \\ \Delta P\omega' \\ \Delta Z' \end{bmatrix} = \begin{bmatrix} \frac{-D}{2H} & \frac{1}{2H} & 0 \\ \frac{R}{T_g} & \frac{2}{T_g} & \frac{2}{T_g} + \frac{2}{T_g} \\ \frac{-1}{R T_g} & 0 & -\frac{1}{T_g} \end{bmatrix} \begin{bmatrix} \Delta\omega \\ \Delta P\omega \\ \Delta Z \end{bmatrix} + \begin{bmatrix} \frac{-1}{2H} & 0 \\ 0 & \frac{-2}{T_g} \\ 0 & \frac{1}{T_g} \end{bmatrix} \begin{bmatrix} \Delta P_{ref} \\ \Delta P_L \end{bmatrix}$$

$$\text{Value matrix } C = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

$$\text{and Value matrix } D = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

Having formed the state space can be searched using the COS value stability. The results in the get are as follows:

#### Controllability

Values obtained rank matrix  $P1 = [3]$  or the same as the order of the matrix  $A$  is  $[3]$ . Matrix values obtained from  $P1 = [B \ AB \ AAB]$

It can be concluded that the hydropower plant can be controlled.

#### Observability

To find a system can be observed or not then look for the value of the first matrix  $P2$ . Matrix  $P2$  is  $P2 = [C1 \ A1C1 \ A2C1]$ .

With :

$$\begin{aligned} C1 &= C' \\ A1C1 &= A' * C' \\ A2C1 &= A' * A' * C' \end{aligned}$$

Then the obtained value  $P2 = [C1 \ A1C1 \ A2C1]$ . Having known the value of the matrix  $P2$  then search rank matrix  $P2$ , if  $P2 = \text{Rank matrix rank matrix } A$ , then the system can be observed.

In the simulation in the following rank values get  $P2 = [3]$  it can be concluded that hydropower can be observed.

#### Stability

Value of the stability of a system can be searched by looking at the eigenvalues of the matrix  $A$  value of a system. System is said to be stable if the eigenvalues of the value is in the same pole (positive or all negative). Eigenvalues obtained like this:

$$\text{Matrix } A = \begin{bmatrix} -1.8538 \\ -6.0295 \\ -22.3667 \end{bmatrix}$$

Eigenvalues of the above it can be seen that the value Hydroelectric stable.

#### Frequency Response

Here is the frequency response of the system obtained from hydropower plants when get a load of 0.1 pu change:



Figure 3. Frequency Response Hydropower

## CONCLUSION

Based on the results obtained from simulation and analysis some conclusions can be drawn :

- Hydroelectric power plant can be controlled because the value matrix rank matrix  $P1 = \text{rank } A = 3$
- Hydroelectric power plant can be observed because the value matrix rank matrix  $P1 = \text{rank } A = 3$
- Hydroelectric power plant stable because all eigenvalues of matrix  $A$  are on the left value of the pole is  $= \begin{bmatrix} -1.8538 \\ -6.0295 \\ -22.3667 \end{bmatrix}$
- Frequency Response generation is stable when the load changes at 0.1pu.

## ENCLOSURE

Below is a listing of programs used to perform the analysis calculations Controllability, Observability and Stability :

```
clc
clear all
```

```
D = 1
H = 2
Tw = 0.1
Tg = 0.1
R = 0.25
```

```
A=[ (-D/(2*H)) ((1/(2*H)) (0) ;
      (2/(R*Tg)) (-2/Tw)
      ((2/Tw)+(2/Tg)) ;
      (-1/(R*Tg)) (0) (-1/Tg) ; ]
```

```
B=[ -(1/(2*H))      0      ;
      0      (-2/Tg)      ;
      0      (1/Tg)      ; ]
```

```
%y = Ax+Bu
```

```
C =eye(3)
```

```
D0=[0];
```

```
%controllability
```

```
P1=[B:AB:AAB:AAAB:AAAAAB]
```

```
B=B;
```

```
AB=A*B;
```

```
AAB=A*A*B;
```

```
AAAB=A*A*A*B;
```

```
AAAAAB=A*A*A*A*B;
```

```
AAAAAB=A*A*A*A*A*B;
```

```
AAAAAB=A*A*A*A*A*A*B;
```

```
P1=[B AB AAB AAAB AAAAB AAAAAB
```

```
AAAAAB];
```

```
rank(P1)
```

```
%observable P2=[C' A'C' A'A'C'
A'A'A'C' A'A'A'A'C']
```

```
C1=C';
```

```
A1C1=A'*C';
```

```
A2C1=A'*A'*C';
```

```
A3C1=A'*A'*A'*C1;
```

```
A4C1=A'*A'*A'*A'*C1;
```

```
A5C1=A'*A'*A'*A'*A'*C1;
```

```
A6C1=A'*A'*A'*A'*A'*A'*C1;
```

```
P2=[C1 A1C1 A2C1 A3C1 A4C1 A5C1
```

```
A6C1];
```

```
rank(P2)
```

```
%stability dilihat dari eigenvalue
```

```
matrik A
```

```
a=eig(A)
```

## Bibliography

- [1] A. Khodabakhshian, R. Hooshmand, "*A new PID controller design for automatic generation control of hydro power systems*". Elsevier, Electrical Power and Energy Systems 32 (2010) 375–382. 2010.
- [2] Robandi Imam, "desain Sistem Tenaga Modern," ANDI Yogyakarta, 2006.
- [3] Robandi Imam, "Modern power Sistem Control," ANDI Yogyakarta, 2009.
- [4] Marsudi, Djiteng, 2006, "Operasi Sistem Tenaga Listrik", Yogyakarta : Graha Ilmu.

## OLTC TRANSFORMER USING AVR WITH FUZZY LOGIC CONTROL

<sup>1)</sup>Yonny Wicaksono, <sup>2)</sup>Imam Robandi

<sup>1)</sup>Jurusan Teknik Elektro ITS, Surabaya 60111, yonny.wicaksono@yahoo.com

<sup>2)</sup>Jurusan Teknik Elektro ITS, Surabaya 60111, robandi@ee.its.ac.id

### Abstract

*This paper will apply fuzzy logic control system on the Automatic Voltage Regulator (AVR). AVR is used to regulate the output voltage through the on-load transformer tap changer (OLTC). simulation is done by looking at the voltage produced by the transformer if the input voltage varies with time varying changes. From the simulation results OLTC fuzzy controlled to maintain output voltage of transformer constant.*

### INTRODUCTION

When the area far away with generator, voltage at this area will drop and unstabil. This happen because losses at the transmission line or load shifting. If the load demand high, voltage will drop and when the load low the voltage will be rise

For make the voltage stabil and still at standart, transformer must have tap changer[1]. Because transformer can make voltage output transformer change with changing the tap of transformer. Because changing tap transformer can make the output voltage constant.

But if the input voltage of transformer always changing. changing tap of transformer will be very difficult. more difficult if the tap changing is off-load tap changing. because That mean tap can be changing if the transformer shut down. the consequently is continuesly power supply will be disturbed.

To overcome these problems, on the transformer can be installed On-Load Tap Changer (OLTC). OLTC is an essential part of modern power systems because the tap of transformer can be changed in a load condition [1].

All control devices at electrical power systems must can react automatically if any deviation on the power systems happened. most of these tasks are handled by the turbine and excitation system. The deviation caused by load demand under unnormal condition, or failure condition at the devices in the transmission or generator. Because of that governoor control devices, automatic voltage regulator, and excitation systems become minimal control device in the electrical power systems[2].

Therefore in this paper will be applied to the OLTC control the AVR using fuzzy logic control. This control will monitor output voltage from transformer, if voltage changing, AVR will give signal at OLTC to changing tha tap until output voltage transformer back at the first condition before the voltage changing.

### AVR WITH FUZZY LOGIC CONTROL

AVR is a device that is used to process voltage data from transformer, and gave signal to OLTC to changing tap at tranformator, so output voltage transformer can be controlled. Basic construction of voltage control transformer use OLTC With AVR can be seen at figure 1.

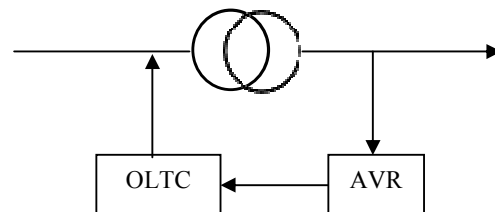


Figure 1. Control Diagram

Transformer output voltage will be measured and compared with voltage reference on the AVR, if the voltage is lower than the setting, the AVR will give orders to lower positions on the OLTC tap on the transformer. if the voltage is measured by AVR remains under voltage reference, OLTC will decrease until the voltage according to voltage reference. and vice versa when the transformer output voltage is greater than the setting, OLTC will increase the tap position.

### Fuzzy Logic

Fuzzy Logic or vague logic is the logic that is built on the principle of uncertainty. Fuzzy logic was first built by Lofti A. Zadeh in 1973. Zadeh said that if the complexity of a system increases, the ability for someone to obtain a precise statement about the behavior of the system will decrease [3].

Fuzzy control is used to determine any movement of OLTC either to increase or decrease the taping accordance with the movement of the

output voltage of the transformer. Fuzzy input is the voltage change and the duration of the voltage change.

## RESULTS AND ANALYSIS

Simulations performed with matlab simulink program. Conducted several experiments by changing the input voltage and the length of time the voltage changes. Permuted input voltage so that the voltage of the output transformer change up or down. Then the observed movement of the OLTC use the Fuzzy logic in control. The results of the simulation are shown in Table 1.

Input Voltage (KV)	Output Voltage(V)	Tap Position
22	400	1
21.5	400	3
21	400	5
20.5	400	7
20	400	9
19.5	400	11
19	400	13
18.5	400	15
18	400	17

From Table 1 it can be seen when the input voltage to 22 kV the value of OLTC tap moves the position of the previous tap 1 is at a nominal voltage of 20 kV tap is taping 9. So is the voltage of 21.5 kV OLTC taping moved from position 1 to position 3. This taping changes following the change in the input voltage of the existing transformer, so that the resulting voltage transformer be fixed in the amount of 400 V.

In this simulation setting the duration of the change in voltage will change with different duration, it is intended to determine pererakan OLTC. results of the simulation are shown in Table 2.

Tabel 2. Tap Position of Transformer

Input Voltage(KV)	Duration(S)	Tap Position
22	5	9
21.5	10	3
21	5	5
20.5	10	9
20	-	9
19.5	10	11
19	5	9
18.5	5	9
18	5	9

In Table 2 it can be seen if the output voltage is changed from 20 KV to 22 KV for 5 seconds then tap position on the OLTC not changed. So is the change of the voltage of 20 KV 19 KV voltage OLTC be fixed in its original position. when the voltage is changed from 20 KV to 21 KV for 15 seconds then it will change the taping of OLTC tap 9 turned into a tap to 5.

## CONCLUSION

By using fuzzy logic control OLTC transformers can be set based on the slew movements and duration of these changes occur. Taping of the input side of the transformer through the OLTC will adjust the output voltage transformers automatically, so that the voltage on the output side will be constant.

## Refference

- [1] S.V.M. Bhuvanaika rao, B.Subramanyeswar,"Fine Voltage Control Using Oltc by Static Tap Change Mechanism,"International Journal of Advanced Computer Research (ISSN (print): 2249-7277 ISSN (online): 2277-7970).
- [2] Imam Robandi, " Modern Power System Control", ANDI Yogyakarta.2009.
- [3] Imam Robandi, " Desain Sistem Tenaga Modern", ANDI Yogyakarta.2006.



## OPTIMAL FUZZY LOGIC CONTROLLER PADA PRESSURIZED WATER REACTOR (PWR) PEMBANGKIT LISTRIK TENAGA NUKLIR MENGGUNAKAN CUCKOO SEARCH ALGORITHM

Prima Dewi Permatasari<sup>1)</sup>, Agus Dharma<sup>2)</sup>, Imam Robandi<sup>3)</sup>

<sup>1,3)</sup> Jurusan Teknik Elektro, Fakultas Teknologi Industri  
Institut Teknologi Sepuluh Nopember (ITS)

<sup>2)</sup> Jurusan Teknik Elektro, Fakultas Teknik  
Universitas Udayana, Denpasar - Bali

Email: primadewi95@yahoo.com<sup>1)</sup>, agus\_dharma@ee.unud.ac.id<sup>2)</sup>, robandi@its.ac.id<sup>3)</sup>

### Abstrak

Salah satu reaktor fisi yang dipakai untuk pembangkit listrik tenaga nuklir adalah reaktor daya jenis PWR (Pressurized Water Reactor). Di dalam sistem primer tidak diperbolehkan terjadi pendidihan, karena itu sistem dibuat bertekanan tinggi. Pada PWR menggunakan air sebagai pendingin dan medium pelambat neutron (moderator neutron) yang bertekanan tinggi dan bertemperatur tinggi untuk mengambil panas dari reaktornya. Dengan menerapkan desain kontroler yang tepat untuk mengatur temperatur dan tekanan pada reaktor dengan set point yang diinginkan agar uap yang dihasilkan tetap stabil walaupun terjadi perubahan beban yang kecil. Dalam tesis ini diberikan metode fuzzy logic controller untuk menentukan besar reaktifitas inti untuk mengendalikan posisi batang kendali pada sistem kontrol reaktor. Parameter masukan untuk logika fuzzy adalah temperatur, tekanan dan jumlah neutron. Untuk mempercepat atau optimasi waktu kestabilan pada reaktor, dioptimasi menggunakan algoritma burung cuckoo setelah dikontrol menggunakan logika fuzzy. Dari hasil simulasi bahwa pada kontrol reaktor mempunyai efisiensi 88% dengan perbandingan daya output generator sebesar 264 MW dan daya output reaktor sebesar 300 MW. Fuzzy-cuckoo search algorithm dapat mereduksi besarnya daya reaktor saat  $t = 16s$ , dengan perbandingan keluaran daya reaktor dengan fuzzy dan fuzzy cuckoo adalah 270 MW dan 192 MW.

**Kata Kunci:** Pressurized Water Reactor, Fuzzy Logic Controller, Cuckoo Search Algorithm

### 1. PENDAHULUAN

Perkembangan energi nuklir di dunia khususnya PLTN dengan teknologi reaktor air bertekanan (Pressurized Water Reactor, PWR) yang

menggunakan uranium sebagai bahan bakar yang menjadi sumber energi primernya. Uranium menjalani proses fission (fisi) di dalam reaktor nuklir yang menghasilkan energi panas yang digunakan untuk menghasilkan uap dalam ketel uap. Uap ini selanjutnya digunakan untuk menggerakkan turbin uap penggerak generator PWR menggunakan air yang bertekanan tinggi untuk mengambil panas dari reaktornya. Tekanan tinggi ini diperlukan agar dalam pemindahan panas dari teras reaktor air tersebut tidak mendidih. Dalam reaktor ini dilengkapi dengan alat pengontrol tekanan (*pressurizer*) yang dipakai untuk mempertahankan sistem pendingin.

Dalam mengendalikan sistem proses yang sangat kompleks serta plant yang sangat sensitif seperti Pembangkit Listrik Tenaga Nuklir (PLTN), pengendalian reaktor nuklir secara manual mempunyai kelemahan karena pada kendali manual unjuk kerjanya sangat bergantung pada kondisi fisik maupun mental psikologis operator, sedangkan jika menggunakan sangat sulit karena reaktor nuklir memiliki variabel dinamika yang non linear dan berubah-ubah, serta model matematis dari reaktor nuklir dan reaksi fisi sangat kompleks dan rumit karena itu tidak mudah menggunakan sistem kontrol optimal sebagai sistem kendali reaktor karena sistem ini membutuhkan model matematis yang menghubungkan antara masukan (input), proses dan keluaran (output) agar dapat mengontrol suatu plant. Untuk mengatasi kelemahan ini maka sistem kontrol logika Fuzzy dapat menjadi salah satu alternatif untuk sistem pengendalian reaktor nuklir yang dipergunakan dalam pembangkit listrik tenaga nuklir (PLTN). Pada penelitian ini, optimal fuzzy logic controller menggunakan metode algoritma burung cuckoo untuk menghasilkan performansi sistem yang lebih stabil sesuai dengan set point yang diinginkan.

## 2. DASAR TEORI

Untuk mendukung terselesainya tesis ini maka diperlukan teori yang menunjang sesuai dengan penelitian.

### 2.1. Fuzzy Logic Controller

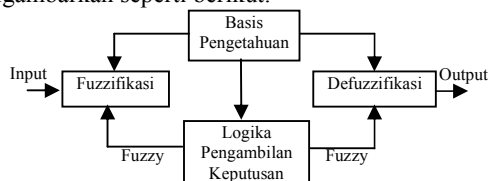
Konsep logika fuzzy adalah merubah konsep logika klasik menjadi konsep yang memetakan suatu variabel pada kemungkinan yang tidak eksak sehingga dapat sistem linguistik dan permasalahan yang tidak pasti atau tidak presisi serta permasalahan probabilitas. Beberapa faktor penting yang menjadi bahasan dalam logika fuzzy sebagai berikut [11] :

#### 2.1.1. Himpunan Fuzzy

Himpunan Crisp dapat dinyatakan sebagai nilai yang sebenarnya untuk menyatakan konsep relative, misalnya seperti kecepatan dan posisi. Di dalam penggunaannya, himpunan ini sangatlah terbatas berbeda dengan ekspresi linguistik. Himpunan fuzzy memberikan kerangka untuk menyatakan ekspresi pendekatan variabel linguistic di atas.

#### 2.1.2. Struktur Dasar Logika Fuzzy

Pada dasarnya struktur logika fuzzy dapat digambarkan seperti berikut:



Gambar 2.1. Struktur Dasar Logika Fuzzy[5]

Fungsi dari bagian-bagian di atas adalah sebagai berikut[5]:

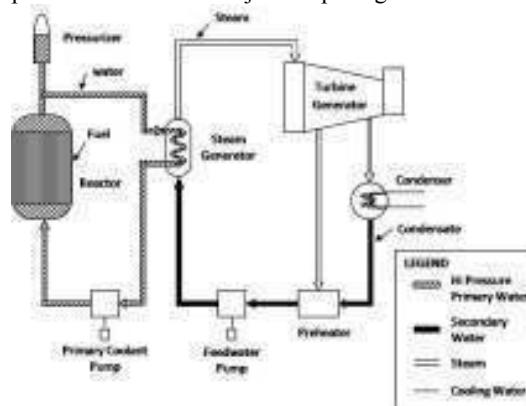
1. Fuzzifikasi  
Befungsi untuk mentransformasikan sinyal masukan yang bersifat crisp ( bukan fuzzy ) ke himpunan fuzzy dengan menggunakan operator fuzzifikasi.
2. Basis Pengetahuan  
Berisi basis data dan aturan dasar yang mendefinisikan himpunan fuzzy atas daerah – daerah masukan dan keluaran dan menyusunnya dalam perangkat aturan kontrol.
3. Logika Pengambil Keputusan  
Merupakan inti dari Logika Fuzzy yang mempunyai kemampuan seperti manusia dalam mengambil keputusan. Aksi atur fuzzy disimpulkan dengan menggunakan implikasi fuzzy dan mekanisme inferensi fuzzy.
4. Defuzzifikasi  
Befungsi untuk mentransformasikan kesimpulan tentang aksi atur yang bersifat fuzzy

menjadi sinyal sebenarnya yang bersifat crisp dengan menggunakan operator defuzzifikasi

### 2.2. Reaktor Nuklir

Reaktor adalah suatu alat proses tempat di mana terjadinya suatu reaksi berlangsung, baik itu reaksi kimia atau nuklir dan bukan secara fisika. Dengan terjadinya reaksi inilah suatu bahan berubah ke bentuk bahan lainnya, perubahannya ada yang terjadi secara spontanialias terjadi dengan sendirinya atau bisa juga butuh bantuan energi seperti panas (contohenergi yang paling umum). Perubahan yang dimaksud adalah perubahan kimia, jadi terjadi perubahan bahan bukan fasa misalnya dari air menjadi uap yang merupakan reaksi fisika.

Terdapat 2 jenis reaktor, yaitu reaktor kimia dan reaktor nuklir. Kedua jenis reaktor tersebut berbeda dalam beberapa hal, yang paling mencolok adalah dalam reaktor kimia hukum kekekalan massa memegang peranan yang sangat penting, karena tidak ada massa yang hilang dalam reaksi ia hanya berubah dari satu jenis bahan ke bahan ke jenis yang lain. Sedangkan reaktor nuklir tidak seperti itu, dalam reaktor ini ada massa yang hilang untuk diubah ke bentuk energi yang memang untuk inilah reaktor nuklir dirancang. Model komponen pada model PWR ditunjukkan pada gambar 2.2.



Gambar 2.2 Model Komponen pada model plant PWR

#### 2.2.1 Batang Kendali

Batang kendali terbuat dari bahan-bahan penyerap netron, seperti boron dan kadmium. Jika reaktor menjadi superkritis, batang kendali secara otomatis bergerak masuk lebih dalam ke dalam teras reaktor untuk menyerap kelebihan netron yang menyebabkan kondisi itu kembali ke kondisi kritis. Sebaliknya, jika reaktor menjadi subkritis, batang kendali sebagian ditarik menjauhi teras reaktor sehingga lebih sedikit netron yang diserap. Dengan demikian, lebih banyak netron tersedia untuk reaksi

fisi dan reaktor kembali ke kondisi kritis. Untuk menghentikan operasi reaktor (misal untuk perawatan), batang kendali turun penuh sehingga seluruh neutron diserap dan reaksi fisi berhenti.

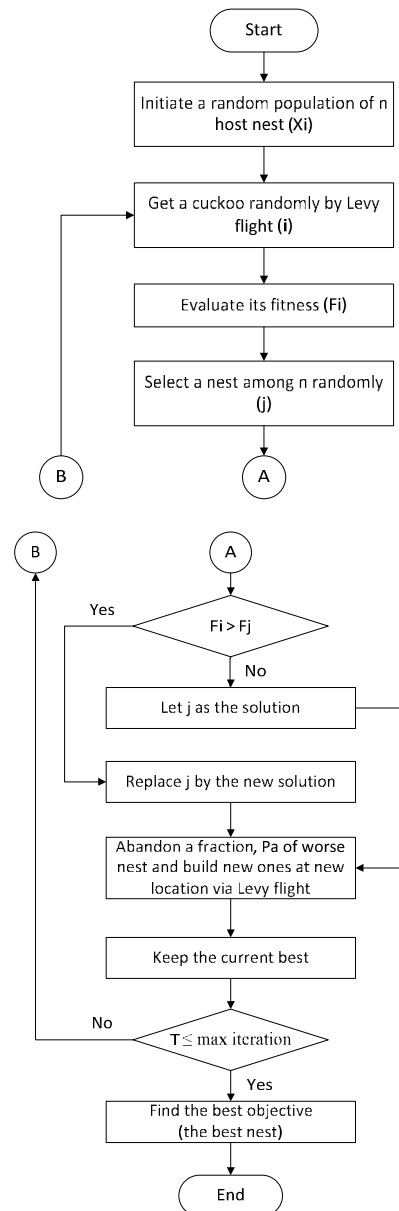
### 2.3 Cuckoo Search Algorithm via Levy Flight

Burung cuckoo dalam berkembangbiak memiliki cara yang beragam dan unik. Dari sekian spesies cuckoo diketahui bahwa 59 diantaranya merupakan cuckoo yang bersifat parasit dalam berkembangbiak yaitu mereka memanfaatkan sarang burung lain yang berbeda spesies untuk menetas telur mereka. Bahkan tak jarang burung cuckoo yang menaruh telur pada sarang burung cuckoo yang lain. Perilaku parasit pada cuckoo dibagi menjadi 3, pembiakan parasit intraspesifik, pembiakan kooperatif dan pengambilalihan sarang [6]. Ada beberapa jenis cuckoo yang membuang telur dari induk asli pada sarang untuk meningkatkan kemungkinan menetas telur mereka.

Mungkin saja terjadi konflik antara burung host dan burung cuckoo pada saat burung cuckoo menaruh telurnya, sehingga burung host membuang telur cuckoo tersebut atau meninggalkan sarang mereka kemudian membuat sarang yang baru. Perilaku parasit yang lain adalah saat burung cuckoo menetas, biasanya telur burung cuckoo menetas lebih awal dari telur burung host, telur burung yang belum menetas tadi dibuang dari sarang agar anak cuckoo tersebut mendapatkan lebih banyak makanan. Bahkan cuckoo mampu melakukan mimikri pada suara burung host kecil.

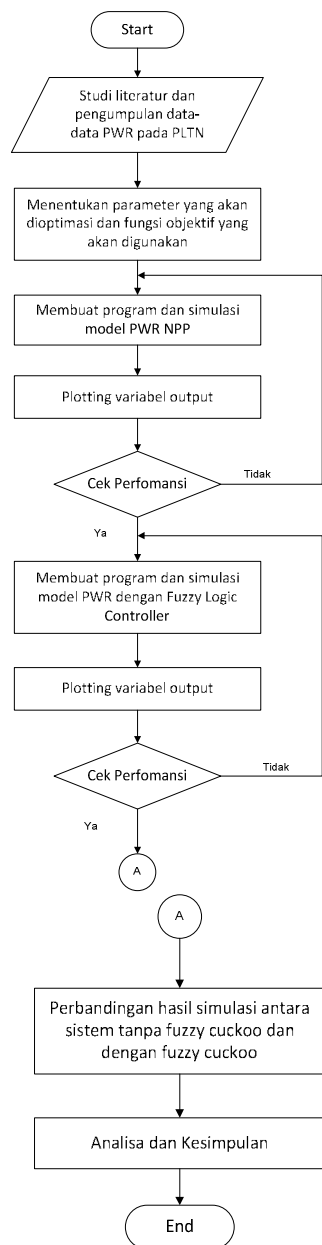
Pada program, untuk penyederhanaan, penemu CS (Cuckoo Search) Xin She Yang dan Suash Deb menggunakan beberapa aturan antara lain :

1. Setiap cuckoo meletakkan satu telur pada satu waktu dan membuang telur di dalamnya pada sarang yang dipilih acak.
2. Sarang terbaik dengan kualitas telur tertinggi akan dibawa ke generasi berikutnya.
3. Jumlah sarang burung inang yang tersedia berjumlah tetap, dan peluang telur yang diletakkan oleh seekor cuckoo ditemukan burung inang sebesar  $p_a \in [0,1]$ . Dalam kasus ini, burung inang dapat membuang telur cuckoo atau meninggalkan sarang, lalu membuat sebuah sarang baru [6].



Gambar 2.3 Flowchart Cuckoo Search Algorithm

### 3. METODOLOGI



Gambar 3.1 Diagram alir simulasi sistem

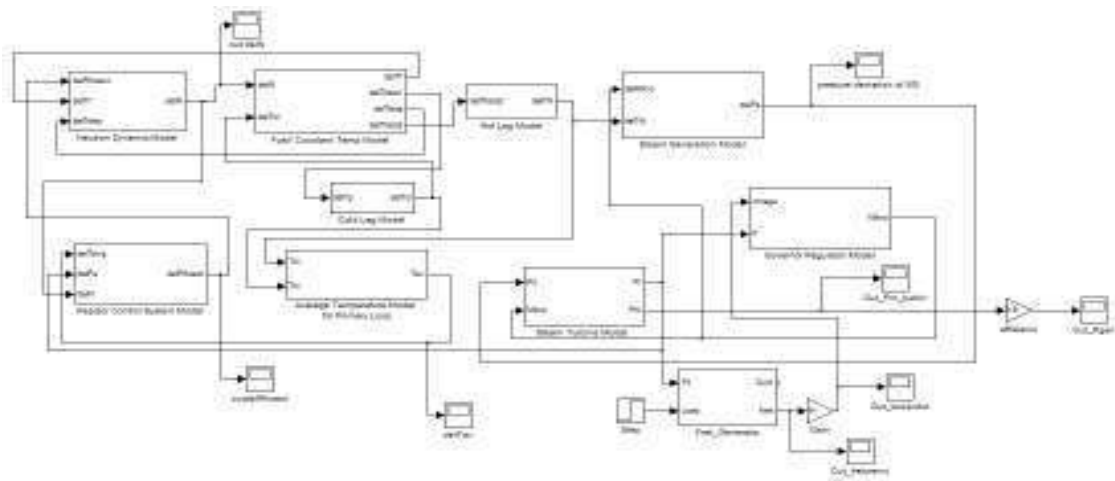
#### 3.1. Pemodelan Plant

Plant untuk sistem pengendalian reaktor nuklir adalah teras reaktor. Pemodelan plant sistem ini dilakukan dengan mengumpulkan data masukan-keluaran yang berasal dari jurnal-jurnal yang digunakan sebagai literatur antara lain *IEEE Transaction On Nuclear Science* dan *ELSEVIER (Nuclear Engineering and Design)*. Data pasangan masukan keluaran yang digunakan dalam pemodelan plant ini adalah data masukan yang berupa temperatur, tekanan dan jumlah neutron untuk mengendalikan batang kendali yang ada di teras reaktor dan data keluaran berupa daya reaktor. Pemodelan ini melalui dua tahap, yaitu *training* dan *validasi*. Sebanyak 80% data masukan-keluaran plant tersebut akan digunakan untuk proses pelatihan (*training*) dan sisanya, akan digunakan untuk proses validasi. Pemodelan plant PWR NPP ditunjukkan pada gambar 3.2.

#### 3.2. Pemodelan Kontroler

Pada sistem pengendalian reaktor nuklir ini variabel yang akan dikendalikan, antara lain : suhu dan tekanan untuk mengatur posisi batang kendali dan jumlah neutron. Keluaran yang dihasilkan berupa posisi batang kendali pada teras reaktor.

Untuk membuat pemodelan kontroler dengan metode *fuzzy* langkah yang dilakukan adalah menentukan variabel masukan, variabel keluaran, fungsi keanggotaan, yang meliputi jenis fungsi yang digunakan dan batas-batas dari fungsi tersebut, serta rule atau aturan untuk melakukan aksi control, dan metode *defuzifikasi*.



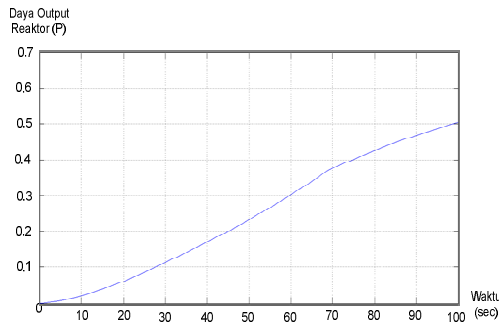
Gambar 3.2 Pemodelan PWR NPP

#### 4. HASIL PENELITIAN

Dari hasil penelitian secara simulasi didapatkan hasil dari berbagai performansi sistem, antara lain:

##### 4.1. Hasil Simulasi Reaktor Kontrol

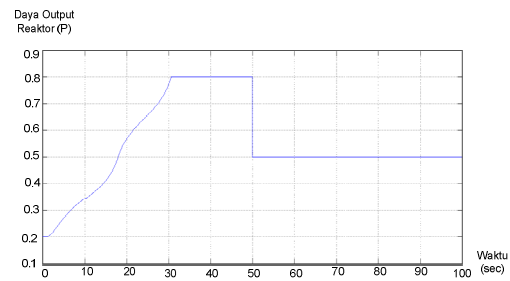
Daya keluaran reaktor sebesar 600 MW sebagai  $P_{base}$ . Daya reaktor sebelum dikontrol menggunakan fuzzy linier terhadap waktu yaitu ketika  $t = 100$  secon besar daya keluaran pada reaktor sebesar 300 MW. Ditunjukkan pada gambar 4.1.



Gambar 4.1  $P_{out}$  reaktor sebelum di kontrol

Sedangkan untuk daya keluaran reaktor setelah dikontrol menggunakan logika fuzzy steady state pada  $t = 50$  secon dan daya keluaran reaktor sebesar 300 MW. Ditunjukkan pada gambar 4.2, daya keluaran reaktor mendekati setpoint dengan overshoot saat  $t = 30$  secon sebesar 480 MW.

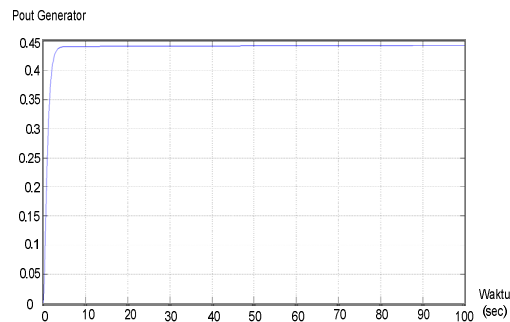
Dari hasil simulasi dapat diketahui efisiensi pada reaktor setelah dikontrol sebesar 88%.



Gambar 4.2  $P_{out}$  reaktor setelah di kontrol menggunakan fuzzy logic controller

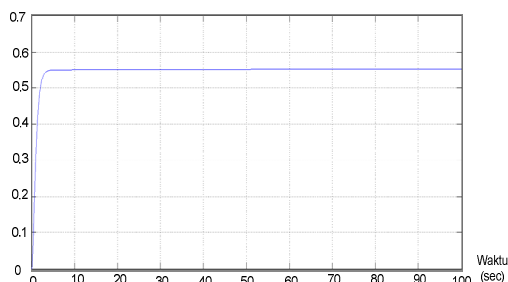
##### 4.2. Respon dari PWR Nuclear Power Plant

Uap yang dihasilkan dari reaktor mampu memutar generator dengan keluaran daya output pada generator adalah  $P_{out\_gen} = 264$  MW. Dengan efisiensi generator sebesar 80%.



Gambar 4.3  $P_{out}$  Generator

Sedangkan untuk keluaran daya mekanik turbin sebesar 330 MW, sistem stabil pada waktu ( $t$ ) = 3 second.



Gambar 4.4  $P_m$  (Daya Mekanik) Turbin

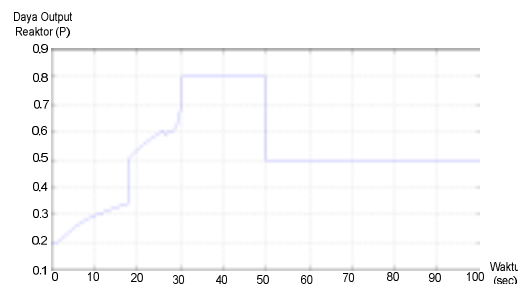
Untuk menentukan nilai parameter temperatur, tekanan dan  $\Delta N$  sesuai dengan setpoint agar pada reaktor tidak terjadi pendidihan maka dioptimasi menggunakan algoritma burung cuckoo pada kontrol logika fuzzy. Perbandingan nilai parameter saat dikontrol menggunakan fuzzy logic controller dengan fuzzy cuckoo search algorithm dapat dilihat pada Tabel 4.1.

Dari data tabel 4.1, bahwa dengan menggunakan kontrol optimasi fuzzy-cuckoo search algorithm pada reaktor kontrol, hasilnya lebih mendekati dengan setpoint yang diijinkan untuk kondisi reaktor kontrol.

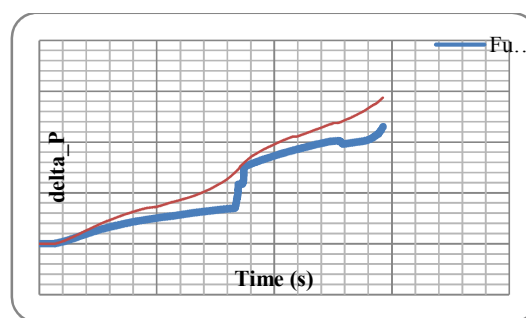
Tabel 4.1. Perbandingan nilai parameter saat dikontrol menggunakan fuzzy logic controller dengan fuzzy cuckoo search algorithm

Parameter	Fuzzy Logic Controller	Fuzzy-Cuckoo Search Algorithm
$\Delta T$	175°C	325°C
$\Delta P$	85,68 kg/ cm <sup>2</sup>	166 kg/ cm <sup>2</sup>
$\Delta N$	0,99 p.u	0,51 p.u

Dengan menggunakan kontrol optimasi fuzzy-cuckoo search algorithm, keluaran daya reaktor dapat dilihat pada Gambar 4.8. Sedangkan perbandingan keluaran daya reaktor dengan fuzzy dan fuzzy cuckoo search algoritim dapat dilihat pada Gambar 4.9. Fuzzy-cuckoo search algorithm dapat mereduksi besarnya daya reaktor saat  $t = 16$  s, daya reaktor yang dikontrol menggunakan fuzzy logic controller sebesar 270 MW. Sedangkan untuk kontrol optimal fuzzy-cuckoo sebesar 192 MW.



Gambar 4.5  $P_{out}$  reaktor setelah dioptimasi menggunakan cuckoo search algorithm



Gambar 4.6 Perbandingan output daya reaktor dengan fuzzy dan fuzzy cuckoo search algoritim

## 5. KESIMPULAN

1. Dari perhitungan perbandingan daya output generator dan daya reaktor dapat dilihat efisiensi PLTN 88 %.
2. Pengendalian daya menggunakan algoritma burung cuckoo dapat mereduksi besarnya daya reaktor saat  $t = 16$  s, daya reaktor yang dikontrol menggunakan fuzzy logic controller sebesar 270 MW. Sedangkan untuk kontrol optimal fuzzy-cuckoo sebesar 192 MW.

## Daftar Pustaka

- [1] Li Xiong, Dinchen Liu, Xi Shi, Jie Zhao, Ping Wu, "Research and Analyse for Pressurized Water Reactor Plant into Power System Dynamic Simulation", IEEE, 2009.
- [2] Jie Zhao, Ping Wu, Dichen Liu, "User-defined Modeling of Pressurized Water Reactor Nuclear Power Plant Based on PSASP and Analysis of its Characteristics", IEEE, 2009.
- [3] Zhou Xiuming, Gan Fulin, Zhong Wenhua, etc, "The Pressurized Water Reactor Nuclear Power Plant Model for the Study of the Interaction between Power System and Nuclear Power Plant under Large Disturbance", Nuclear Power Engineering, vol. 17, no. 1, pp. 6-12, Feb, 1996.

- [4] Pramath Ramaswamy, Martin Riese, Robert M. Edwards, and Kwang Y. Lee, "Two Approaches For Automating The Tuning Process Of Fuzzy Logic Controllers", IEEE 1993.
- [5] Hartadi, Dwi. 2006. Perancangan Sistem Pengendalian Temperatur Menggunakan Metode Fuzzy Gain Scheduling PID Controller Pada Continous Tank Reaktor (CSTR). Surabaya : Institut Teknologi Sepuluh Nopember, 2006.
- [6] Xin-She Yang, "Cuckoo Search via L'evy Flights", IEEE Maret 2010.
- [7] Xin-She Yang, "Engineering Optimisation by Cuckoo Search", Des 2010.
- [8] H. Levent Akin and Vural Altin, "Rule Based Fuzzy Logic Controller for a PWR Type Nuclear Power Plant", IEEE 1991.
- [9] Wenpeng LANG, M. Tahir KHALEEQ, David Guosem HE, Weiqing ZHAO. "Digital Optimal Level Controller For Steam Generator in Nuclear Power Plant PWR", IEEE 1996.
- [10] Hu Xuehao, Zhang Xuecheng, "Pressurized Water Reactor Nuclear Power Plant (NPP) Modelling and The Midterm Dynamic Simulation After NPP has been Introduced Into Power System", IEEE TENCON 1993.
- [11] Herry Gunawan W, Syamsul Arifin. "Perancangan Sistem Pengendalian Daya Reaktor Nuklir Menggunakan Logika Fuzzy Di Pusat Teknologi Nuklir Bahan Dan Radiometri Badan Tenaga Nuklir Nasional (PTNBR Batan) Bandung". Surabaya : Institut Teknologi Sepuluh Nopember, 2010.

## MANAJEMEN ALIRAN DAYA PADA SISTEM PENGGERAK ELEKTRIK MOTOR INDUKSI BERBASISKAN MULTILEVEL INVERTER JEMBATAN-H BERTINGKAT UNTUK APLIKASI MOBIL MATAHARI (SOLAR CAR)

<sup>1)</sup> **Muhamad Otong**, <sup>2)</sup> **Dedet Candra Riawan**, <sup>3)</sup> **Imam Robandi**

<sup>1)</sup> Teknik Elektro – ITS,  
Kampus ITS Keputih Sukolio Surabaya Jawa Timur 60111 - Indonesia  
Email: muhamadotonguntirta@yahoo.com

<sup>2,3)</sup> Teknik Elektro - ITS,  
Kampus ITS Keputih Sukolio Surabaya Jawa Timur 6011 - Indonesia  
Email: dedet@ee.its.ac.id  
Email : robandi@ee.its.ac.id

### Abstrak

Makalah ini membahas tentang pengalokasian besarnya daya listrik yang harus disuplai atau diserap oleh sumber PV/battery dan supercapacitor terhadap beban motor induksi, yaitu terutama sekali ketika kendaraan solar car mengalami proses percepatan (acceleration), dan atau proses pengereman (braking). Prinsip manajemen aliran daya dilakukan berdasarkan prinsip charging/discharging pada elemen penyimpan energi listrik (battery dan supercapacitor). Dengan menggunakan teknik hibrid PWM pada proses pensaklaran (switching) pada rangkaian multilevel konverter jembatan-H beringkat (Cascaded H-Bridge Multilevel Converter - CHBMLI) proses aliran daya antara sumber dan beban sedemikian rupa dapat diatur. Tujuan manajemen aliran daya ini adalah untuk menjamin pasokan atau penyerapan aliran daya listrik secara optimal antara sumber daya dan beban motor induksi. Sinyal tegangan referensi (input) pada CHBMLI didapat dari sinyal kendali kecepatan motor induksi dengan menggunakan metoda Field Oriented Control (FOC) Desain strategi pengalokasian beban pada sumber daya PV/battery dan supercapacitor dilakukan oleh CHBMLI berdasarkan metode ekstraksi daya aktif dan daya reaktif. Untuk memverifikasi dan memvalidasi konsep manajemen aliran daya yang diusulkan, eksperimen dilakukan dengan menggunakan metode simulasi software Matlab/Simulink

**Kata Kunci:** manajemen, aliran daya, PV, Battery, Supercapacitor, motor induksi, FOC, Konverter, H-Bridge, PLL, Solar Car

### PENDAHULUAN

Mobil matahari (solar car) adalah salah satu

jenis kendaraan listrik (*electric vehicle*), yang mana mesin penggeraknya menggunakan mesin (motor) listrik. Penggunaan kendaraan listrik sebagai alat transportasi darat (yang berupa mobil), merupakan salah satu bentuk solusi alternatif untuk mengatasi masalah krisis energi bahan bakar minyak (BBM) dan masalah kerusakan lingkungan[4]. Keuntungan yang utama digunakannya kendaraan solar car ini adalah : tidak menggunakan energi bahan bakar minyak (BBM), mesin penggeraknya menggunakan peralatan/mesin listrik, kebutuhan energi listriknya dapat diserap dan dikonversi langsung dari energi sinar matahari dengan menggunakan sistem *photovoltaic* (PV), tidak mengeluarkan gas buang (*zero emission*), tidak mengeluarkan suara bising (*noise*), dan perawatannya relatif mudah (*low maintenance*).

Masalah yang sangat mendasar sekali pada perancangan solar car adalah menentukan besarnya kebutuhan daya listrik yang dapat diserap dari energi sinar matahari yang terekendala secara langsung dengan besarnya ukuran luas permukaan PV yang berpengaruh langsung dengan dimensi/ukuran berat kendaraan, sehingga kapasitas bebannya menjadi terbatas. Selain itu, masalah lain yang mempengaruhi kinerja (*performance*) kendaraan adalah faktor adanya kondisi siang dan malam, pengaruh cuaca, iklim, musim, letak geografis, faktor terhalangnya sinar matahari oleh awan/pohon, dan lain sebagainya[6]. Jelaslah hal ini akan mengganggu perubahan suplai/pasokan aliran daya ke sistem dan akhirnya juga akan mengurangi *performance* (kinerja) dalam pengoperasian kendaraan solar car [7].

Oleh karena itu, untuk membantu penambahan kapasitas daya dan untuk menjamin sistem pasokan atau penyerapan aliran daya listrik pada kendaraan solar car dengan baik, salah satu bentuk solusi



yang sesuai dengan masalah diatas adalah dengan memanfaatkan dan menggabungkan elemen sistem penyimpan energi (*Energy Storage System - ESS*) seperti *battery* dan *supercapacitor* [1,2,3,4,6].

Penggabungan ESS terhadap sistem suplai daya pada kendaraan *solar car*, ini artinya juga menyebabkan penggunaan rangkaian konverter daya yang banyak dan bertahap-tahap (*multi stage converter*). Satu metode pendekatan topologi terhadap masalah ini adalah dengan menggunakan topologi rangkaian konverter daya CHBMLI [5,6,8]. Keuntungan yang utama digunakannya topologi CHBMLI adalah efisiensinya tinggi, dapat mengurangi jumlah *stage* konverter daya yang digunakan, dapat diaplikasikan untuk daya dan tegangan beban yang tinggi, mengurangi kandungan harmonisa, dan masukkan sumber daya yang digunakannya dapat berupa dari berbagai macam tipe sumber daya. CHBMLI sudah banyak diteliti dan diterapkan untuk berbagai macam aplikasi misalnya, untuk sistem penggerak elektrik motor (*Motor Electric Drive System*), STATCOM, UPS, dsb [8].

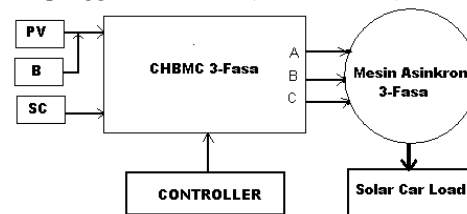
Dalam makalah ini akan dibahas penggunaan CHBMLI untuk sistem penggerak elektrik motor induksi 3-fasa pada kendaraan *solar car*, dimana sumber daya DC yang digunakannya berasal dari *PV/Battery* dan *Supercapacitor*. Pembahasan pada makalah ini hanya dikhususkan untuk mengatur (manajemen) distribusi aliran daya antara sumber daya DC *PV/Battery* dan *Supercapacitor*, yang mana tujuannya adalah untuk menjamin kestabilan dan kehandalan sistem suplai daya ketika terjadi perubahan beban, (terutama ketika permintaan beban daya puncak), mengoptimalkan aliran daya antara sumber dan beban, memberikan kompensasi daya aktif dan reaktif dengan *range* interval yang lebar, dan untuk memperbaiki kualitas daya (*Power Quality*) yang dihasilkan oleh CHBMLI [3,6].

Kunci penyelesaian untuk mendapatkan tujuan diatas adalah : (1) bagaimana mengekstrak daya aktif dan daya reaktif pada keluaran (*output*) CHBMLI, (2) Bagaimana mengatur (manajemen) aliran daya untuk mendistribusikan suplai daya antara PV, *battery* dan *supercapacitor*, (3) bagaimana mendesain sistem kontrol-nya [6].

Pembahasan pada makalah ini dimulai dengan menjelaskan topologi CHBMLI, kemudian analisa diagram vektor digunakan untuk menjelaskan prinsip manajemen distribusi aliran daya antara *PV/Battery* dan *Supercapacitor*, selanjutnya bagaimana penjelasan sistem kontrol didesain, dan eksperimen dilakukan dengan menggunakan simulasi software Matlab/Simulink untuk memverifikasi dan validasi konsep yang diusulkan.

## DESKRIPSI DAN ANALISIS

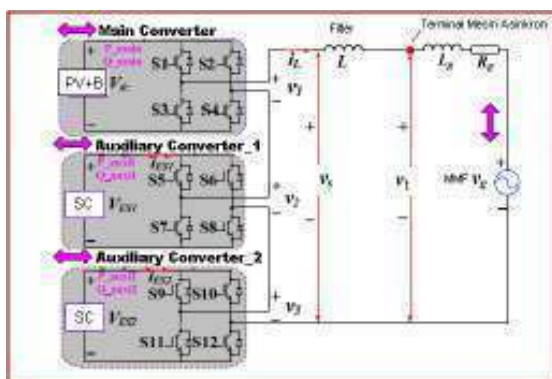
Gambar 1 menunjukkan diagram blok sistem penggerak elektrik 3-fasa pada kendaraan *solar car*, yang mena terdiri dari 3komponen utama, yaitu sumber daya listrik (*PV/Battery* dan *Supercapacitor*), konverter daya (CHBMLI), dan mesin penggerak mekanis (motor induksi).



Gambar 1. Sistem penggerak elektrik pada *solar car*

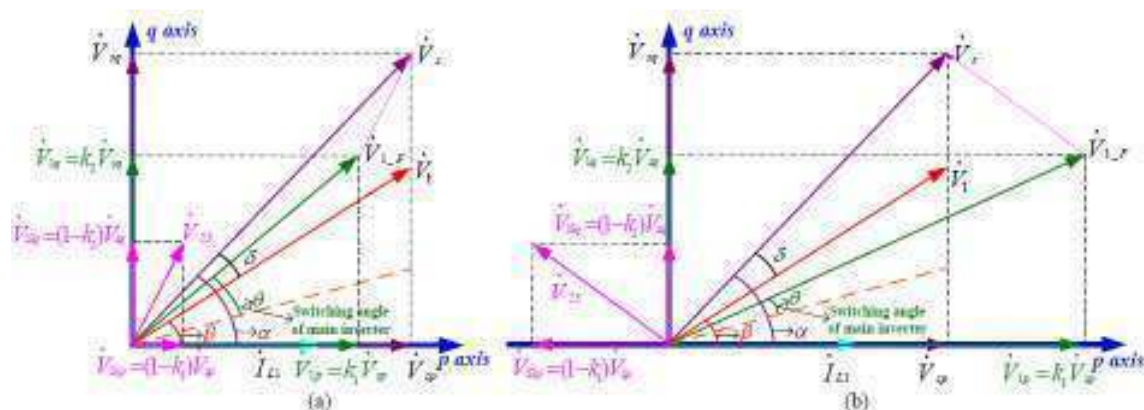
Gambar 2 Adalah topologi CHBMLI (hanya satu fasa yang ditunjukkan), motor induksi diekivalenkan dengan rangkaian seri R-L dan tegangan MMF. CHBMLI tersusun dengan tiga buah rangkaian konverter jembatan-H yang dikaskadekan (hubungan seri), yang mana terdiri dari satu buah rangkaian "main converter" dengan sumber DC yang berasal dari paralel *PV/battery*, dan dua buah rangkaian "auxiliary converter" dengan sumber DC yang berasal dari *supercapacitor*. Rasio tegangan antara  $V_{dc}$ ,  $V_{ES1}$ , dan  $V_{ES2}$  adalah 2:1:1. Untuk mengendalikan aliran daya, CHBMLI di *switching* dengan menggunakan teknik modulasi gabungan (*hybrid*) digunakan, dimana *main converter* menggunakan modulasi pada frekuensi dasar, dan *auxiliary converter* menggunakan *phase-shift modulation* (PSM) sinusoidal pada frekuensi tinggi.

CHBMLI dihubungkan ke motor induksi melalui rangkaian filter  $L$ , yang berfungsi untuk mengurangi harmonisa dan memperbaiki respon dinamis sistem.  $R_g$  dan  $L_g$  adalah resistansi dan induktansi pada stator motor induksi, yang mana dapat digunakan untuk menginvestigasi pengaruh aliran daya pada tegangan terminal mesin asinkron. Arah aliran daya terjadi dalam bentuk *bidirectional* (dua-arrah).



Gambar 2. Topologi CHBMC satu fasa

Diagram vektor diusulkan, seperti yang ditunjukkan oleh Gambar 3, dan digunakan untuk menjelaskan prinsip manajemen alirandaya untuk pendistribusian alokasi besarnya daya aktif dan daya reaktif yang harus disuplai/ diserap antara sumber DC (PV-battery) dan ESS (supercapacitor). Koordinat sumbu  $pq$  dibuat berotasi pada frekuensi sinkron.  $I_{L1}$ ,  $\dot{V}_s$ ,  $\dot{V}_t$  berturut-turut adalah vektor dari  $i_{L1}$ ,  $v_s$ ,  $v_t$ . Vektor  $\dot{V}_{1-F}$  adalah komponen dasar dari tegangan keluaran main converter.  $\dot{V}_{1p}$  dan  $\dot{V}_{1q}$  adalah vektor komponen dari  $\dot{V}_{1-F}$  pada sumbu  $pq$ .



Gambar 3. Diagram untuk alokasi daya aktif dan dayareaktif, (a) ESS discharge mode, (b) ESS charge mode

Sudut beda fasa  $\beta$  antara vektor  $\dot{V}_t$  dan  $\dot{I}_{L1}$ , dihitung dengan menggunakan :

$$\beta = \tan^{-1} \left( \frac{P_g}{Q_g} \right) \quad (2)$$

Sudut beda fasa  $\alpha$  antara vektor  $\dot{V}_s$  dan  $\dot{I}_{L1}$ , dihitung dengan menjumlahkan persamaan 1 dan persamaan 2:

$$\alpha = \delta + \beta \quad (\text{persamaan 3})$$

Berdasarkan persamaan 3 dan analisa deret Fourier besarnya sudut switching  $\theta$  adalah, (persamaan 4) :

Juga vektor  $\dot{V}_{sp}$  dan  $\dot{V}_{sq}$  adalah vektor komponen dari  $\dot{V}_s$  pada sumbu  $pq$ . Koefisien  $k_1$  dan  $k_2$  adalah definisi besarnya alokasi daya aktif dan daya reaktif. Sudut  $\alpha$  adalah sudut beda fasa antara vektor  $\dot{V}_s$  dan  $\dot{I}_{L1}$ . Sudut  $\beta$  adalah sudut beda fasa antara vektor  $\dot{V}_t$  dan  $\dot{I}_{L1}$ . Sudut  $\theta$  adalah sudut switching pada main converter.

Gambar 3(a) menunjukkan diagram vektor alokasi dayapada ESS (supercapacitor) ketika beroperasi dalam discharge mode. Dalam kasus ini ESS akan mengirimkan daya aktif dan daya reaktif ke beban (motor induksi). Gambar 3(b) menunjukkan diagram vektor alokasi dayapada ESS ketika beroperasi dalam charge mode. Dalam kasus ini ESS akan menerima/menyerap daya aktif dari beban (motor induksi).

Sudut beda fasa  $\delta$  antara vektor  $\dot{V}_t$  dan  $\dot{V}_s$ , dihitung dengan menggunakan :

$$\delta = \tan^{-1} \left( \frac{P_g \times 2\omega L}{Q_g \times 2\omega L + V_t^2} \right) \quad (1)$$

Dimana :  $P_g$  dan  $Q_g$  adalah daya aktif dan daya reaktif MMF.  $\omega$  adalah frekuensi dasar.  $L$  adalah induktansi filter.  $V_t$  adalah amplitudo tegangan terminal mesin  $v_t$ .

$$\theta = \cos^{-1} \left[ \frac{V_s}{V_{dc}} \times \frac{\pi}{4} \times \sqrt{(k_1 \cos \alpha)^2 + (k_2 \sin \alpha)^2} \right]$$

Dimana :  $V_s$  adalah amplitudo tegangan keluaran  $v_s$  CHBMC, dan  $V_{dc}$  adalah besarnya tegangan sumber DC (paralel PV-battery).

## DESAIN SISTEM KONTROL

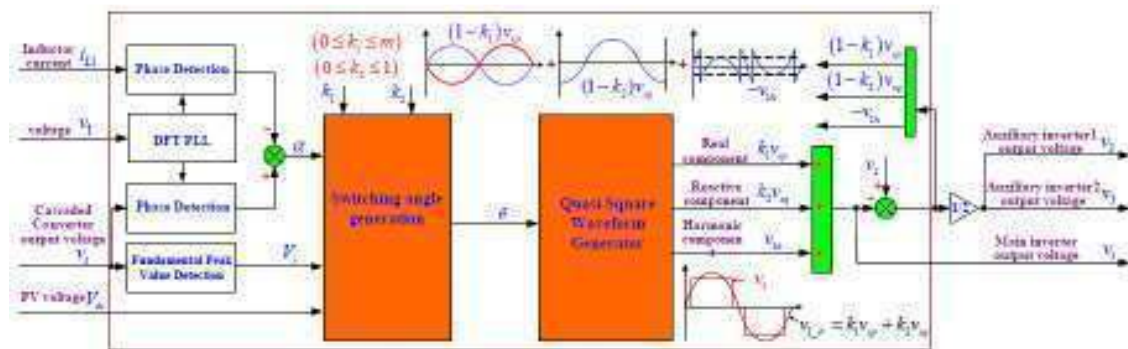
Alokasi daya yang diberikan/diserap antara sumber DC (PV/battery) dan ESS (supercapacitor) tergantung pada komponen daya aktif dan daya reaktif keluaran  $v_s$  dari CHBMC. Oleh karena itu,

ekstraksi komponen daya aktif dan daya reaktif pada  $v_s$  harus diperoleh.

#### A. Setrategi Distribusi Aliran Daya

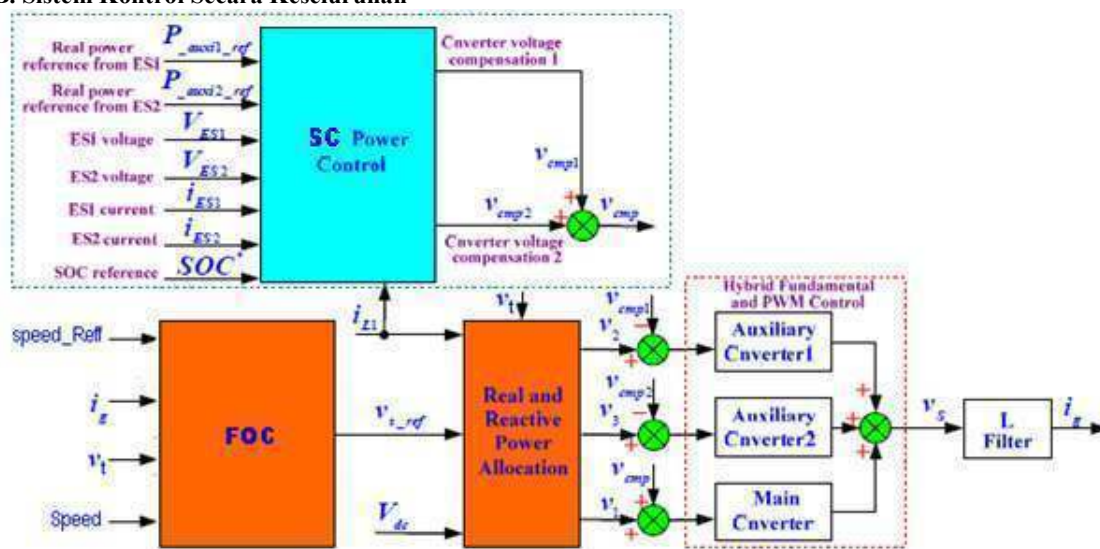
Setrategi Distribusi aliran daya diusulkan dengan menggunakan PLL (*phase locked loop*) seperti yang ditunjukkan oleh Gambar 4. Blok modul PLL membangkitkan sudut fasa dan frekuensi pada tegangan  $v_s$ , sehingga  $i_{L1}$  dan  $v_s$  dapat disinkronisasikan. Dua buah blok modul "Phase Detection" digunakan untuk mendeteksi sudut fasa  $i_{L1}$  dan  $v_s$  dan mengurangkannya dengan sudut fasa  $v_s$ , dengan demikian sudut fasa  $\alpha$  bisa didapatkan. Besarnya amplitudo  $V_s$  diperoleh

melalui blok modul "Fundamental Peak Value Detection". Koefisien  $k_1$  dan  $k_2$  besarnya ditentukan dan digunakan untuk mengestimasi sudut  $\theta$  dalam blok modul "Switching Angle Generation". Pemilihan nilai  $k_1$  tergantung pada persyaratan daya dan batas *overvoltage*. Komponen harmonisa  $v_{1h}$  dapat di reduksi dengan membuat negatif  $v_{1h}$  pada masukkan sinyal *auxiliary converter*, dimana fungsinya adalah untuk memperbaiki kualitas daya. Auxiliary converter dapat menyediakan komponen daya aktif dan reaktif sisa-nya,  $(1-k_1)v_{sp}$  dan  $(1-k_2)v_{sq}$ . Dengan cara demikian, manajemen aliran daya aktif dan daya reaktif dapat didistribusikan antara sumber DC (PV/battery) dan ESS (*supercapacitor*).



Gambar 4. Setrategi manajemen aliran daya aktif dan reaktif yang diusulkan

#### B. Sistem Kontrol Secara Keseluruhan



Gambar 5. Diagram blok sistem kontrol secara keseluruhan

Gambar 5 adalah diagram blok sistem kontrol secara keseluruhan. Pengoperasian mesin asinkron dikendalikan oleh blok modul "Field Oriented

Control (FOC)", dan keluarannya adalah sinyal referensi  $v_{t-ref}$ . Blok modul "active and reactive allocation" sudah dibahas secara detail seperti yang

ditunjukkan oleh Gambar 4, dan keluarannya memberikan sinyal referensi  $v_1$ ,  $v_2$ , dan  $v_3$ . Blok modul "supercapacitor power control" didesain untk menghasilkan *charge/discharge* untuk keseimbangan tegangan (*voltage ballancng*) pada supercapacitor.

#### SIMULASI DAN PEMBAHASAN

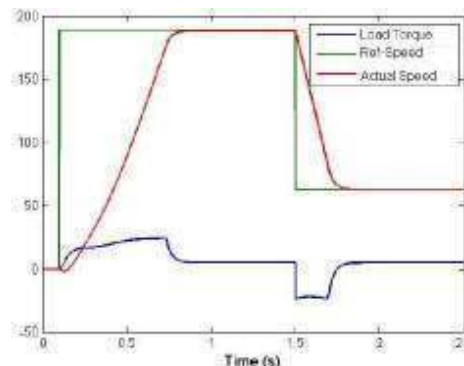
Kinerja setrategi distribusi aliran daya menggunakan CHBMC yang diusulkan di uji dengan melakukan simulasi. Gambar 8 adalah diagram blok sistem yang disimulasikan dengan menggunakan software Matlab/Simulink. Parameter mesin asinkron ditunjukkan pada tabel 1. Dan parameter sumber DC (*PV-battery*) dan ESS (*supercapacitor*) ditunjukkan pada tabel 2.

Gambar 6 adalah hasil simulasi respon *speed* aktual dan torsi beban terhadap sinyal *speed* referensi. Gambar 7 adalah respon daya yang disuplai oleh sumber DC (*PV-Battery*) dan ESS (*supercapacitor*). Gambar 8 adalah respon arus stator motor induksi ketika *speed* bervariasi. Gambar 9 adalah respon tegangan stator ketika *speed* bervariasi.

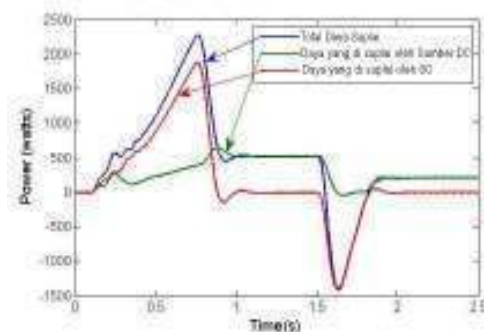
Tabel 1. Parameter Sumber DC dan ESS

Parameter	Nilai
Tegangan Sumber DC	150 V (DC)
Tegangan SC (ESS)	75 V (DC)
Kapasitansi SC (ESS)	0.14 F

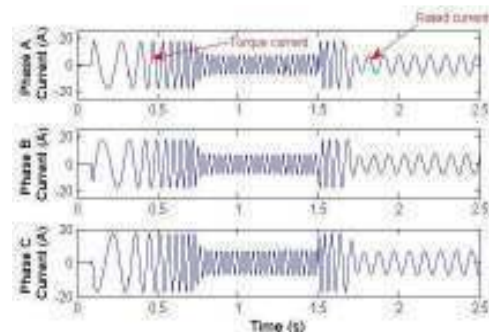
Parameter	Nilai
Rating Daya	5 HP
Tegangan	230 V <sub>L-L</sub> (RMS)
Jumlah kutub	4
Base Frekuensi	60 Hz
Resistansi stator	0.5814 Ohm
Resistansi rotor	0.4165 Ohm
Induktansi bocor stator	3.479e-3 H
Induktansi bocor rotor	4.15e-3 H
Induktansi magnetisasi	78.25e-3 H
Moment inersia	0.1kgm <sup>2</sup>



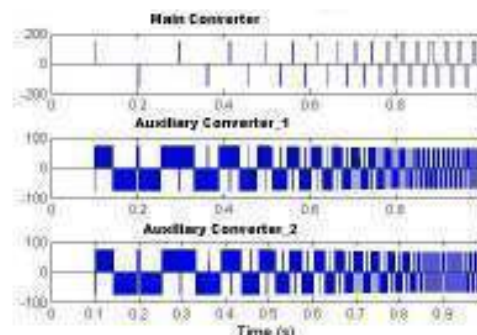
Gambar 6. Respon *speed*\_aktual,  $T_L$ , *Speed*\_Ref



Gambar 7. adalah respon daya yang disuplai oleh sumber DC (*PV-Battery*) dan ESS (*supercapacitor*)



Gambar 8. Respon arus stator



Gambar 9. Tegangan pada CHBMC Fasa-A

## KESIMPULAN

Dalam makalah ini telah dibahas dan dilakukan simulasi untuk menguji keefektifan metode manajemen distribusi aliran daya dengan menggunakan CHBMC. Ketika daya puncak (percepatan dan perlambatan/pengereman) terjadi (Gambar 7), sebagian besar daya yang disuplai/diserap dilakukan oleh *supercapacitor* dari pada oleh PV/Battery, hal ini telah membuktikan dan memvalidasi konsep manajemen aliran daya yang diusulkan.

## Daftar Referensi

- [1] S. Lu, K. A. Corzine, T. H. Fikse, "Advanced Control of Cascaded Multilevel Drives based on p-q Theory," in Proc. IEEE International Conference on Electric Machines and Drives, May 15-18, 2005, pp.1415-1422.
- [2] S. Lu, K. A. Corzine, M. Ferdowsi, "A New Method of Utilizing Ultracapacitor Energy Sources in Hybrid Electric Vehicles Over a Wide Speed Range," 22nd Annual IEEE APEC, Feb.25-March 01, 2007, pp. 222-228.
- [3] S. Azongha, L. Liu, H. Li, "Utilizing Ultracapacitor Energy Storage in Motor Drives with Cascaded Multilevel Inverters," Journal IEEE, 7/08/2008.
- [4] M. Lafoz, L. Garcia-Tabares, M. Blanco, "Energy Management in Solar Photovoltaic Plants based on ESS," EPE-PEMC, Sep. 2008, vol. 2, pp. 2481-2486.
- [5] L. Liu, Z. Wu, H. Li, "A Single-stage Grid-connected Inverter with Wide Range Reactive Power Compensation using Energy Storage System (ESS)," in Proc. IEEE APEC, Feb. 2010, vol. 1, pp. 223-230.
- [6] L.Liu, Y. Zhou, H.Li, "Coordinated Active and Reactive Power Management Implementation Based on Dual-stage PLL Method for Grid-connected PV System with Battery," Journal IEEE, 3/10/2010.
- [7] A. F. Burke, "Batteries and Ultracapacitors for Electric, Hybrid, and Fuel Cell Vehicles," Proceedings of the IEEE, Vol. 95, No. 4, April 2007.
- [8] B. Wu, "HIGH-POWER CONVERTERS AND AC DRIVES," IEEE Press, A John Wiley & Sons, Inc., Publication, 2006.

## TRADITIONAL AND NEW COMPLEMENTARY THERAPY OF NURSING

**Panarut Wisawatapnimit**

Boromarajonani College of Nursing, Bangkok, Thailand

Complementary health approaches have been developed and increased uses in nursing. There are many traditional and complementary health approaches practicing in nursing, including natural products, and body and mind practices. Indeed, many countries in some regions, especially China, India, and Greek have used traditional medicine for curing and healing clients for long time and still maintain or preserve to use it although western and modern medicine are growing. Current and future trends of using traditional and complementary modalities in nursing practices are increasing and systematic studies are conducted to prove its benefits. Therefore, nurses need to understand and integrate traditional and complementary health approached in their care for reaching holistic approach.

### Definition of Terms

Many terms are used related to complementary and alternative medicine and some terms are used interchangeably. These terms are “traditional medicine (TRM)”, “complementary and alternative medicine (CAM)”, “complementary medicine”, “alternative medicine,” and “integrative medicine”. Therefore, it needs to understand meaning of each term.

Traditional medicine is the knowledge, skills and practices of holistic healthcare, recognized and accepted for its role in the maintenance of health and the treatment of diseases. It is based on indigenous theories, beliefs and experiences that are handed down from generation to generation (Seung-Hoon, 2009, p.20). Traditional medicine is a comprehensive term used to refer both to traditional medicine systems such as traditional Chinese medicine, Indian Ayur vedic medicine and Arabic Unani medicine, and to various forms of indigenous medicine (Seung-Hoon, 2009). Seung-Hoon (2009) also illustrated that in western countries where traditional medicine has not been incorporated into the national health care system, the terms as “alternative medicine”, “complementary medicine”, or “nonconventional medicine” is used. Therefore, “traditional medicine” is used when referring to Africa, Latin America, South-East Asia, and/or the Western Pacific, whereas “complementary and alternative

medicine” is used when referring to Europe and/or North America (and Australia). Seung-Hoon (2009) suggested that to refer in a general sense of all regions, the comprehensive TRM/CAM should be used.

National Center for Complementary and Alternative Medicine (NCCAM) of the U.S. Department of Health & Services, National Institute of Health defined that complementary medicine generally refers to using a non-mainstream approach together with conventional medicine whereas alternative medicine refers to using a non-mainstream approach in place of conventional medicine. However, using true alternative medicine is not common because most people use complementary medicine along with conventional treatments and the boundaries between complementary and conventional medicine overlap and change with time (National Center for Complementary and Alternative Medicine, 2013). However, NCCAM (2013) generally identified that NCCAM uses the term “complementary health approaches” for practices and products that studies in various health conditions.

Because people are interesting on maintaining their health or staying well and health care providers more focuses on holistic approach, the trend to integrate conventional medicine and CAM for providing care is increasing. The term “integrative medicine” is used and defined as conventional therapies combined with CAM where there is evidence of safety and effectiveness (Cady, 2009 cited in College and Association of Registered Nurses of Alberta, 2011). NCCM (2013) also supported that the integrative medicine’s trend is growing. Many individuals, health care providers, and healthcare system are integrating various practices into treatment and health promotion.

### Categories of Complementary and Alternative Medicine

NCCM (2013) has categorized complementary and alternative medicine into 2 main categories as follows:

1. Natural products include a variety of products, such as herbs (also known as botanicals), vitamins and minerals, and probiotics.



2. Mind and body practices include a large and diverse group of procedures or techniques administered or taught by a trained practitioner or teacher. For example,
  - Acupuncture is a technique in which practitioners stimulate specific points on the body—most often by inserting thin needles through the skin.
  - Massage therapy includes many different techniques in which practitioners manually manipulate the soft tissues of the body.
  - Meditation techniques, such as mindfulness meditation or transcendental meditation, involve ways in which a person learns to focus attention.
  - Movement therapies include a broad range of Eastern and Western movement-based approaches.
  - Relaxation techniques, such as breathing exercises, guided imagery, and progressive muscle relaxation, are designed to produce the body's natural relaxation response.
  - Spinal manipulation is practiced by health care professionals such as chiropractors, osteopathic physicians, naturopathic physicians, physical therapists, and some medical doctors. Practitioners perform spinal manipulation by using their hands or a device to apply a controlled force to a joint of the spine. The amount of force applied depends on the form of manipulation used.
  - Tai chi and qi gong are practices from traditional Chinese medicine that combine specific movements or postures, coordinated breathing, and mental focus.
  - The various styles of yoga used for health purposes typically combine physical postures or movement, breathing techniques, and meditation.
  - Other examples of mind and body practices include healing touch and hypnotherapy.

Although these two broad categories cover most complementary health approaches, some approaches, such as traditional healers, may not neatly fit into these categories and are considered as other complementary health approaches (NCCM, 2013).

#### **Complementary Health Approaches in Nursing**

Nursing is a holistic approach as its essence (Frisch, 2006). Nursing theories defined nursing by considering the clients as the whole. Because of holistic approach, from the past until now, nurses have demonstrated great enthusiasm to integrate

complementary and alternative modalities to care physical, mental, emotional, and spiritual dimensions of the clients (Frisch, 2006).

For example, in Mid 1950s, Leininger originally developed transcultural nursing concept and the Theory of Cultural Care Diversity and Universality to guide nurses for understanding and incorporating cultural care as called generic (folk) care and professional care into nursing care practices (Leininger & McFarland, 2001). Leininger identified that caring is essence of nursing and caring refers to actions and activities directed toward assisting, supporting, or enabling another individual or group with evident or anticipated needs to ease, heal, or improve a human condition or lifeway or to face death or disability (Leininger, 2001, p. 47). Leininger believed that every culture has specific beliefs values, and pattern of caring and healing that nurses as cares need to discover, understand, and used in the care of people. Human caring with a transcultural care focus is essential for the health, healing, and well-being of individuals, families, groups, and institutions (Leininger & McFarland, 2001, p. 62). Therefore, Leininger's theory supports for using TRM/CAM in nursing practices.

Frisch (2006) also illustrated some examples of nursing theories that support of using complementary modalities in nursing. For example, using music therapy and aromatherapy to alter the stimuli and change unhealthy or noxious environmental stimuli are guided by Roy's Theory of Adaptation. Using therapeutic touch and healing touch techniques for improving human and environmental energy fields of clients are able to explain by the concept of human energy field and environmental energy field, such as Rogers' Theory of Unitary Human Beings.

There are evidence reported that nurses have been used complementary therapies in their care. Dossey, Frish, Forker, & Lavin, (1998 cited in Frisch, 2006) conducted a study and found that majority of 708 nurses who defined themselves as holistic nurses used alternative or complementary modalities in their nursing practice with the main purpose to enhance their clients' healing. Modalities most frequently used by these nurses were acupressure, aromatherapy, biofeedback, guided imagery, healing presence, humor, journaling, music therapy, meditation, relaxation, and therapeutic touch/healing touch.

In addition, the CAM is added in well-known Nursing Interventions Classification (NIC) to guide the nursing intervention in some nursing diagnosis classification of North American Nursing Diagnosis

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

Association (NANDA). For example, for the NANDA diagnosis of disturbed sleep pattern, music therapy as provided through tape recorded music at times of wakefulness is one of nursing

intervention (Frisch, 2006). Other complementary modalities to solve nursing problems are as shown in Table 1.

Table 1. Selected Nursing Diagnoses and Nursing Interventions: Possible Pairing of Nursing Concerns and Complementary/Alternative Interventions

Nursing Diagnosis/Concern	Nursing Intervention(s)	Rationale
Impaired comfort	Acupressure, Therapeutic Touch	To decrease perceived pain
Disturbed sleep pattern	Massage	To promote relaxation, rest
Social isolation	Animal-assisted therapy	To provide affection
Impaired coping	Humor	To facilitate appreciation of that which is funny, to relieve tensions
Hopelessness	Hope instillation	To promote a positive sense of the future
Spiritual distress	Spiritual support	To facilitate a sense of inner peace
Spiritual well-being	Spiritual growth facilitation	To support growth/reflection reexamination of values
Anxiety or fear	Guided imagery, relaxation theory, biofeedback, calming techniques	To reduce sense of anxiety
Impaired communication	Art therapy	To facilitate expression

**Source:** Frisch, N.C. (2006). Nursing as a context for alternative/complementary modalities. In Andrist, L. C., Nicholas, P. K., Wolf, K.A. (Eds) (2006). A history of nursing ideas. Sudbury, Massachusetts: Jones and Bartlett Publishers. P 433.

### Current and Future Trends Related to Complementary Health Approaches in Nursing

People in global are increasing their interests toward good health. Some of them try to improve their health by changing their life-styles for healthy purposes, such as eating healthy diets, exercising, and practicing their mind. Some patients also seek alternative ways to solve their health problems by not rely on western or modern medicine only. They use TRM/CAM or would like to combine using both western medicine and TRA/CAM. Therefore, it is necessary for nurses to have knowledge about TRM/CAM for discussing with patients. In addition, the number of nurses who focus on holistic approach are increasing. They try to use TRA/CAM in their nursing practices with the purposes for caring and healing their clients, relieving some suffer symptoms from some diseases that cannot be cured such as cancer or dementia, and restoring health of clients. Although trend to use TRM/CAM are increasing, challenges related with using these approaches are still concern. Lack of sound scientific evidence about the efficacy of some TRM/CAM, limitations of dissemination the evidence, and problems in ensuring its proper use (Seung-Hoon (2009) are main challenges related to using these modalities. Therefore, many nurses have been conducted studies to examine the efficacy of TRM/CAM,

appropriate programs and doses, and develop new therapies or modalities to deal with needs and complex health problems.

For example, Fitzhenry, Wells, Slater, Dietrich, Wisawatapnimit, Chakravarthy (2013) conducted a randomized placebo-controlled pilot study of the impact of healing touch on fatigue in breast cancer patients undergoing radiation therapy. Healing touch is energy based therapy. Although the main findings do not support a beneficial effect of healing touch on fatigue or quality of life when compared to a sham intervention, the enrollment and retention to the trial indicate that it is feasible and acceptable to women during RT. Researchers suggested that future research may need to explore increasing dose and teasing out therapist effect.

Gustafsson and Asplund (Malardalen University, 2013) have been developed new way of complimentary health approach that is called as a robot cat for enhancing quality of life among people with dementia. This is initiative project launched in 2011 and in continuing development. However, the results of pilot studies showed tendencies towards the quality of life being enhanced and the outward behavior symptoms decreasing.

Somporn Kantharadussadee Triamchaisri has developed the SKTs Meditation exercise for 20 years. The SKTs compose of SKT1 – 7. Nowadays, these techniques are trained and used widely in



Thailand. Many studies were also conducted to examine efficacy of the SKTs Meditation exercise. There are evidences to support that the SKTs are appropriate exercise for general people, chronic disease patients, such as hypertension, diabetes mellitus, and stroke, as well as terminal illness patients, such as patients with cancer, HIV positive, and end stage renal disease because it helps to reduce blood pressure and blood sugar, and improve quality of life. An example study about the efficacy of SKT was conducted in people living with end stage renal disease (ESRD). The main findings found that after ESRD patients practiced SKT6 for 6 months, their satisfaction, psychological and spiritual well-beings, and quality of life increased. Therefore, the SKT6 meditation healing exercises affected the quality of life, satisfaction, and uncertainty in life with the illness significantly (Triamchaisri, Mawn, & Artsanthia, 2013).

In addition to research studies, standards related to use complimentary health approaches has been developed. An example of the standards when CAM and/or natural health products (NHPs) are used as an adjunct to nursing practice in Canada (College and Association of Registered Nurses of Alberta, 2011). The standards identify that to use CAM and/or NHPs, nurses must:

- Have the competency (knowledge, skill, judgment and attitudes) to provide the therapy in a safe, competent and ethical manner;
- Have successfully completed appropriate educational or certificate programs from credited sources to prepare themselves to provide the therapy. In some situation (e.g. acupuncture), licensure with another regulatory body may be necessary;
- Use reliable sources of information and examine the evidence to determine that the therapy is safe and effective including consultation with a pharmacists or other health care providers as necessary. All pharmacies are required to have a NHP reference;
- Use their knowledge and critical judgment to identify risk and expected outcomes, and to determine if the therapy is appropriate to the client situation;
- Be aware of the intended effects, possible side effects, interactions with other therapies, adverse reaction reporting requirements of Health Canada and be prepared to provide care in relation to any expected or unexpected effects of the therapy---including plans for backup care if it is needed;
- Document nursing care related to CAM therapies in the client record documentation including

nursing history and assessment of the use of CAM and NHPs, discussion regarding the history of the condition, risks and benefits of conventional treatment, client and families decision not to proceed with conventional therapy, risks and benefits of a proposed CAM therapy and families response to that, and planning, intervention, and evaluation of care and the therapy;

- Assess clients respecting the use of CAM and/or NHPs and encourage their clients to inform their other health care providers of CAM they engage in and NHPs they are using.

### **Traditional Medicine and Complementary Health Approaches in Thailand**

Thailand has its own system of traditional medicine called “Thai traditional medicine” (TTM), originated during the Sukhothai period (1238-1377). However, when the western medicine has been widely used in Thailand, the practices of TTM have been declined and eventually replaced. TTM was neglected for over 60 years until the revival of TTM began in the late 1970s (Chokevivat & Chuthaputti, 2005).

According to the “Protection and Promotion of Thai Traditional Medicine Wisdom Act B.E. 2542” (1999 cited in Chokevivat & Chuthaputti, 2005), Thai traditional medicine is defined as “the medical processes dealing with the examination, diagnosis, therapy, treatment, or prevention of diseases, or promotion and rehabilitation of the health of humans or animals, midwifery, Thai massage, as well as the preparation, production of Thai traditional medicines and the making of devices and instruments for medical purposes. All of these are based on the knowledge or textbooks that were passed on and developed from generation to generation”. In other words, TTM is regarded as comprising the traditional philosophies, bodies of knowledge and modes of practice to care for the health of Thai people that are congruent with Thai culture and way of life, and based on the principles of Buddhism. TTM uses various forms of practices to complement each other, i.e., medicine, pharmacy, massage, midwifery and maternal and child health care, Buddhist rites and meditation, as well as other rituals based on the belief in supernatural power or power of the universe (Chokevivat & Chuthaputti, 2005).

Thai traditional medicine draws from Indian and Chinese systems of traditional medicine. It encompasses a holistic philosophy and is based principally on plants, including the use of herbal saunas, herbal medicines, herbal steam baths, and hot compresses; traditional massage; acupressure;

and reflexology. Practitioners of traditional medicine represent an important resource for the Thai health care system (WHO, 2001).

#### **The Principles of Thai Traditional Medicine** (Chokevivat & Chuthaputti, 2005)

##### **The four elements (*tard*) of the body**

According to TTM, the human body is composed of four elements ('*tard*' in the Thai language), i.e., earth, water, wind and fire. When the four elements of the body are in equilibrium, it will be healthy. In contrast, if an imbalance in these elements occurs, i.e., if there is a deficit, an excess, or disability in any of the four elements, a person will become ill.

##### **The causes of illness**

According to TTM, human illness can be caused by the following factors:

1. Supernatural power, e.g., ancestor's soul, powerful spirit of the forest, evil spirits, punishment from a heavenly spirit of those who misbehave.
2. Power of Nature, e.g., imbalance in the four elements of the body, imbalance of heat and cold, and imbalance of the body's equilibrium.
3. Power of the universe, e.g., positive and negative influences from the sun, the moon, and the stars on human health.
4. *Kimijati*, which may be considered the equivalent of microorganisms or parasites in modern medicine.

#### **The role of Thai traditional medicine in health promotion** (Chokevivat & Chuthaputti, 2005)

Since the beginning of the revival of TTM in 1978, various aspects and practices of TTM have been promoted for the health promotion of the Thai people and/or integrated into the national health service system, namely:

1. Medicinal plants and traditional medicines
  - Turmeric for dyspepsia
  - *Senna alata* for constipation
  - *Andrographis paniculata* for pharyngotonsillitis and diarrhea
  - *Zingiber cassumunar* for bruises and muscle sprains
  - *Clinanthus nutans* for herpes simplex and herpes zoster infection of the skin, cold sores, skin rash, hives and itching.
2. Thai massage or *nuad thai*

Thai traditional massage or *nuad thai* is a branch of TTM and a form of manual therapy that can be used for health promotion or relaxation and can also effectively cure or

relieve several symptoms and diseases, e.g., myofascial painsyndrome, frozen shoulder, carpal tunnel syndrome, and tension headache.

3. Hot herbal compresses and herbal steam baths

Hot herbal compresses have been used for hundreds of years by Thais to relieve muscle sprains, muscular and joint pain, and discomfort. The herbal compress called *luk pra kob* in Thai is a blend of herbs, including *plai* (*Zingiber cassumunar* rhizome), turmeric, lemongrass, kaffir-lime peel, with salt, camphor and borneol camphor wrapped and tied in a cotton cloth to make a round shaped ball with a handle on top. Before its application to the affected areas of the body, *luk pra kob* must be steamed for about 10-15 minutes. The heat helps to increase the regional blood flow and the release of volatile oils from the herbs helps to exert anti-inflammatory action on the affected muscles.

Herbal steam baths, based on TTM, can be used for therapeutic or health promotion purposes. The principle of an herbal steam bath is to boil a combination of herbs and volatile substances, similar to those used in hot herbal compresses, in a steam room or a closed chamber. The steam and the volatile substances that contact the skin exert a local effect, and when inhaled, will affect the respiratory system and exert a systemic effect. The health benefits of an herbal steam bath are, i.e., stimulation of the circulatory and respiratory systems, relief of muscle tension and pain, skin rash and stress, nourishment of the skin and improved excretion of body waste; originally it was used for postpartum care.

4. The Practice of *dhammanamai*. *Dhammanamai* is the application of Buddhist teachings in TTM for holistic health care of the body, the mind, the society and the environment which is composed of *Kayanamai* (healthy body), *Jitanamai* (healthy mind), and *Chevitanaamai* (healthy lifestyle).
  - *Kayanamai* (healthy body)

Eat good food, especially indigenous nutritious fruits and vegetables that are compatible with one's own *tard* or underlying disease, and take traditional medicines or food that can correct the imbalance of *tard* to maintain good health. For example, vegetables and fruits that help reduce body heat during summer are those with a bitter or cool and bland taste, e.g., bitter melon, bitter cucumber, watermelon, morning glory tips, pumpkin, sweet potato, okra, eggplant, Chinese chive,

horseradish-tree pod and young inflorescence of Siamese neem. On the contrary, spicy or greasy food is not suitable during summer because it will be a fire element in the body and generate more heat. Meanwhile, vegetables and fruits suitable for the rainy season and the dry season are those that are used as spices.

Exercise, e.g., *ruesi-dud-ton*, or Thai traditional stretch exercise *Ruesi* means “hermit” and *dud ton* means “body stretch exercise”. The word *ruesi dud ton* is derived from the belief that in the past hermits who resided in the forest to seek enlightenment usually sat in one position for a long time while doing meditation. They then created and performed a series of stretch exercise to relieve the muscle fatigue and stiffness that occurred after long hours of meditation. While performing *ruesi dud ton*, one also practices breathing exercises and meditation by focusing on breathing rhythm. Hence, the health benefits of *ruesi dud ton* are increased body agility and muscle coordination, stimulated blood circulation and promotion of good concentration.

- Jitanamai (healthy mind), i.e., practice of meditation
- Chevitanamai (healthy lifestyle), e.g., live one's life in the “Middle Path” of Buddhism.

#### Examples of using TTM/CAM in nursing in Thailand

In Thailand, TTM or complementary therapies has been used in nursing for a long period of time, especially Thai herbs, hot herbal compresses, herbal steam baths, massages, and meditation. Complementary health approaches influencing from other countries are also practiced in nursing, such as music therapy, aromatherapy, guided imagery, biofeedback, and yoga. The trend of using TTM/CAM in healthcare and nursing are increased since the TTM is incorporated in Thai health policies.

Due to the Thai Government's policy of reducing the country's medical costs, the Ministry of Public Health, Thailand had told 10,580 hospitals under its supervision nationwide to use at least 20 indigenous herb items in their health services. A total of 71 indigenous herb items have already been included in the national drug list (The Government Public Relations Department, 2013). Consequently, many hospitals in Thailand use herbs and provide choices for clients to select to use some medications between western medication and Thai

herbs as traditional medicine. In addition, many hospitals in Thailand provide Thai massages, herbal saunas for post partum women, and hot compresses for muscle pain or sprain etc.

Examples of health care facilities used TTM/CAM in curing and nursing as follows: Chao Phya Abhaibhubejhr Hospital develops and produces herb products in modern ways and conducts research studies to approve benefits of the products. The products compose of herb medicine, cosmetics, herb teas, etc. These products are used widely for health care providers and people. The hospital also has established a learning center related to Thai traditional medicine. Examples of some herb products produced by the hospital are as follows:

- Centella cream for improving the healing process of wound;
- Ya Pakking (*Murdannia loriformis* or Hassk) capsule for relieving of fever and being immunostimulant;
- Fa Ta Lai Jone (*Andrographis paniculata* Wall ex Ness. Or Kariyat) capsule for relieving of diarrhea, fever, and sore throat; and
- Makham Pom (Indian Gooseberry) Cough Drop for relieving cough

Intensive care units of Queen Sirikit National Institute of Child Health provide music therapy during the quiet hours for promoting babies and children to sleep well and provide massages for relaxing the babies and sick children. They also provide painting class for health care providers to release stress from work.

An intensive care unit of Faculty of Medicine Ramathibodi Hospital, Mahidol University creates environmental health for critically ill patients by having small gardens and artificial waterfall on the sides of patients' rooms. They also provide massages and aromatherapy for patients during quiet time for helping patients relax and sleep.

Theptarin Hospital uses behavioral modification for helping diabetic patients control blood sugar and maintaining good health for healthy people. For behavioral modification, it focuses on eat health foods, exercise. Foot clinic for diabetic patients also uses conventional medicine and maggot therapy to clean out the dead tissue.

Khampramong temple and Arokhayasarn integrates conventional and complimentary medicines such as meditation, herbs detoxication, herbs steam bath, acupuncture, nutrition therapy, music therapy, and spiritual care for caring cancer patients.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

A nurse of Faculty of Medicine Vajira Hospital use power of love and hug to heal palliative patients.

## CONCLUSION

TRM/CAM are used widely in many regions from the past until now. TRM/CAM are also used increasingly in nursing profession with supports by nursing theories, systematic evidence, and standards. However, TRM/CAM in nursing are still needed to further develop with the purposes to test efficacy of these approaches and initiate new modalities to help patients and clients restoring their health, dealing with suffering, and reaching their optimal goals of life that are healthy, having quality of life, and peaceful death. Nurses need to realize that clients have their right to make their own decisions about their care. Therefore, nurses need to learn, understand, and integrate TRM/CAM that are appropriate with clients' contexts, cultures, and ways of life in plan of care with collaboration of clients and their families.

## References

- Chokevivat, V., & Chuthaputti, A. (2005). *The role of Thai traditional medicine in health promotion*. The 6<sup>th</sup> Global Conference on Health Promotion. 7-11 August 2005 Bangkok, Thailand.
- College and Association of Registered Nurses of Alberta. (2011). *Complementary and/or alternative therapy natural health products: Standards for registered nurses*.  
[http://www.nurses.ab.ca/Carna-Admin/Uploads/Complementary\\_Alternative\\_Therapy.pdf](http://www.nurses.ab.ca/Carna-Admin/Uploads/Complementary_Alternative_Therapy.pdf)
- Fitzhenry, F., Wells, N., Slater, V., Dietrich, M.S., Wisawatapnimit, P., Chakravarthy, A.B. (2013). A randomized placebo-controlled pilot study of the impact of healing touch on fatigue in breast cancer patients undergoing radiation therapy. *Integrative Cancer Therapies*. 2013 Oct 7. [Epub ahead of print].
- Frisch, N.C. (2006). Nursing as a context for alternative/complementary modalities. In L. C. Andrist, P. K. Nicholas, & K.A. Wolf (Eds.) (2006), *A history of nursing ideas* (pp. 427 – 434). Sudbury, MA: Jones and Bartlett Publishers.
- Leininger, M. & McFarland, M. R. (Eds.). (2002). *Transcultural nursing: Concepts, theories, research, and practice* (3<sup>rd</sup> ed.). New York: McGraw-Hill.
- Malardalen University. (2013, February, 20) *New way of complimentary health approach: Unique robot cat enhances quality of life among people with dementia*. Retrieved from [http://www.mdh.se/unik-robotkatt-okar-livskvaliteten-hos-personer-med-demens-1.35302?l=en\\_UK](http://www.mdh.se/unik-robotkatt-okar-livskvaliteten-hos-personer-med-demens-1.35302?l=en_UK)
- National Center for Complementary and Alternative Medicine (2013, May). *Complementary, Alternative, or Integrative Health: What's In a Name?* Retrieved from <http://nccam.nih.gov/health/whatiscam>
- Seung-Hoon, C. (2009). *WHO Strategy and Activities in Traditional Medicine*. 明治国際医療大学誌 創刊号 : 19–22. Retrieves from [http://www.meiji-u.ac.jp/bulletin/2009-01/06\\_Choi.pdf](http://www.meiji-u.ac.jp/bulletin/2009-01/06_Choi.pdf)
- The Government Public Relations Department. (2012, March 29). *Ministry of Public Health Promotes Thai Traditional and Alternative Medicine in Hospitals Nationwide*. Retrieves from [http://thailand.prd.go.th/view\\_news.php?id=6213&a=2](http://thailand.prd.go.th/view_news.php?id=6213&a=2)
- Triamchaisri, S. K., Mawn, B. E., & Artsanthia, J. (2013). Development of a Home-Based Palliative Care Model for People Living With End-Stage Renal Disease. *Journal of Hospice and Palliative Nursing*, 15(4), E1 – E11.
- World Health Organization. (2001). *Legal status of traditional medicine and complementary/alternative medicine: A worldwide review*. Retrieved from [http://whqlibdoc.who.int/hq/2001/WHO\\_EDM\\_TRM\\_2001.2.pdf](http://whqlibdoc.who.int/hq/2001/WHO_EDM_TRM_2001.2.pdf)

## EFFECTIVENESS OF ACUPRESSURE MASSAGE TOWARD CHANGE OF MOOD DURING THE MENSTRUAL PERIODS

Agustina Ari Handayani<sup>1</sup>

<sup>1</sup>) Nursing Program of An Nur Health School, Purwodadi-Grobogan  
Email: moleculargustin@yahoo.com

### Abstract

**Background** - disharmony mood when periods can disrupt the balance of life. Acupressure massage can affect mood changes during menstruation. This study aims to analyze the effectiveness of acupressure massage on change of mood during menstruation in Diponegoro vocational high school.

**Method**- quasi experimental study was conducted at grade XI student Diponegoro vocational high school, purposive sampling technique with 20 respondents as sample, group 1 consisted of 10 women receiving acupressure massage treatment, group 2 consisted of 10 women without treatment. Assessment change of mood using the modified POMS (Profile of Mood State) Questionnaire in Spanish. As many as 12 item questionnaire with 0.76 reliability value and validity of the smallest value of 0.31. Delta change of mood was analyzed by Mann Whitney test with a confidence level of 95%.

**Results**- Based on observations in the treatment group mean change of mood delta of 15.5, whereas in the control group by 5.5. The results of the Mann Whitney analysis showed differences in change of mood in the treatment group and the control with  $p$  value  $0.000 > 0.05$

**Conclusion** - Acupressure massage effectively improve change of mood because it makes a better mood. Enhanced participation actively in acupressure during menstrual periods should be done so that students are able to apply to themselves.

**Keywords:** acupressure massage, mood, menstruation, vocational high school

### BACKGROUND

Discomfort during menstruation as a rapidly growing public health problem with high prevalence. The level of discomfort felt by the patient can lead to a decrease in their quality of life. Chauduri and Singh (2012), that the change of mood: irritability to difficulty in concentrating, dominating 8.6% discomfort during menstruation. Acupressure massage is expected to provide a

change in managing their menstrual pain. Farnan (2010), acupressure is defined as “an ancient healing art that uses the fingers to press certain points on the body to stimulate the body’s self-curative abilities”. Acupressure included in the section Traditional Chinese medicine (TCM), is an ancient system of health developed more than 3,000 years ago in Asia. This system is based on the concept that Qi flows throughout the body and that the balance of yin. Represents forces and the health and well-being. Grandi et al (2012), several cases of menstrual discomfort associated with symptoms of depression, headaches, loss of appetite and absency. These conditions have an impact on public health. Dependence on the treatment of very large, ie 65.6%. The impact of drug addiction is extremely dangerous in the long term. More women are also exploring alternative or complimentary therapies in conjunction with traditional medicine to overcome and get relief from menstrual symptoms. Studies conducted have shown evidence of acupressure working successfully to relieve pain, improve digestion, help with depression and anxiety, and enhancing energy levels. Intervention in overcoming menstrual discomfort can be done with acupressure massage.

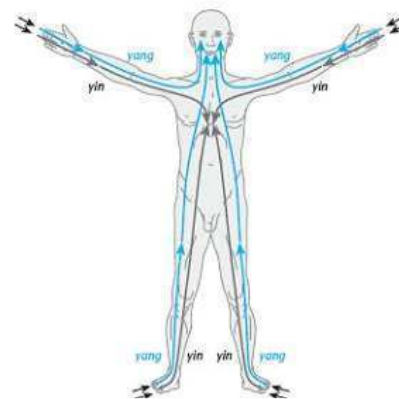


Figure 1. Meridian Path (Flocks, 2008)

Meridian pathways in the human body consists of 14 lines, 12 general lines and two special lines. Meridian meridian generally divided

over the feet and hands. Foot meridian pathways starting from the tip of the toe area and then climbed into the abdomen through the internal organs (viscera) occurred branching out through the neck toward the face and the heart organ. Hands started meridian pathways from the fingertip to the branching occurs along the shoulders and face the direction of the heart. Ren meridian pathways privileged starting from the top of the head down the spine ends in the perineal area. The line is concatenated with Du meridian of the perineum down the middle of the abdomen to the top of head. Which is part of the outer side of the body, yin part is deeper side of the body (Flocks, 2008). This process will improve the overall health promotion in the body. According to Jie (2010), acupoints that contribute to reproduction system are heart, small intestine, liver, gall, kidney, bladder, ren (conception vessel), pericardium, Sanjiao meridians. Wong et al (2010), SP6 meridians (spleen) or San Yin Jiao acupressure has a painkiller effect immediately for dysmenorrhea. In addition, SP6 acupressure applied to three months consecutive was effective in reducing menstrual pain and discomfort. Acupressure massage during menstruation needs to be done at nursing student due to mood management that can be applied broadly. This study aims to analyze the effectiveness of acupressure massage on change of mood during menstruation in SMK Diponegoro.

## METHOD

Quasi-experimental study was conducted on a class XI student of SMK Diponegoro Penawangan-Grobogan. Sampling technique is purposive, sample as many 20 respondents, group 1 consisted of 10 women receiving treatment with acupressure massage, group 2 or control as many as 10 women are not receiving treatment. The sample selection is done based on the inclusion criteria: respondents had never attended extra-curricular meditation, female, the first day of menstruation, never married, no medical therapy in reproductive system, maximum age 18 years. Exclusion criteria : taking anti-pain medication, not willing to follow the study until completion. Selected respondents then stated its ability to informed consent. Respondents fill out a questionnaire consisting of 12 items of data themselves and modification POMS statement (Profile of Mood States) in Spanish from Andrade et al (2010), with a Likert scale of (1-5). The statement is never favorable value (1), the value is always (5). Statement unfavorable never value (5), the value is always (1). The indicators used were depression, hospitality and vigor. Before being used

as a measurement instrument, 12 items tested statement reliability (0.76) and validity (the smallest value of (0.31). Based on test validity and reliability of the 12 items worth statement as a measurement instrument. The value of POMS  $\geq 30$  is bad mood,  $< 30$  is good mood.

Measurements POMS performed on the first day of menstruation before treatment is given in conjunction with the control group. The treatment group was taught to acupressure massage at the point of Sp 6 San Yinjiao located at 3 cun (four fingers) above the medial ankle rear boundary of the tibia, St (Stomach) 30 or Qi Chong is located 5 cun below the navel, pericardium 6 or Nei Guan located at 2 cun above the fold of the wrist, between the tendons of palmaris longus and musculus flexor carpi radialis (Flocks, 2008).



Figure 2. San Yin Jiao (www.tcmdiscovery.com)

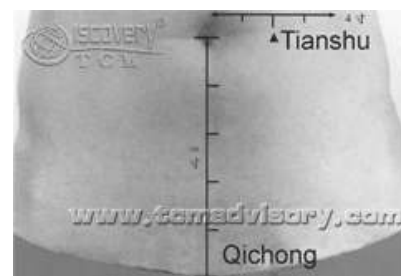


Figure 3. Qichong (www.tcmdiscovery.com)



Figure 4. Nei Guan(www.tcmdiscovery.com)

Especially for abdominal movement is only done with the sweep. Acupressure massage done until the fifth day of menstruation, on the sixth day POMS measured in both groups. When apply acupressure massage used virgin coconut oil from Prima Vico production, Semarang. Delta POMS data analysis for both groups performed with the Mann Whitney test with a confidence level of 95%.

Research hypothesis: There are difference change of mood between treatment acupressure massage group with the untreated group during menstruation.

## RESULTS

Tabel 1. Mood of change

	Groups	N	Mean Rank
Mood of change	control	10	5.5
	treatment	10	15.5
	Total	20	

Change average in mood of treatment group treated is 15.5 while the control group was 5.5. The greater change of mood in the treatment group than the control group.

Tabel 2. Mann Whitney

Z	N	Asymp (2 tailed)
-3.813	20	0.000

Mann Whitney test results in the treatment and control groups showed any difference. It can be seen from Asymp. Sig. (2-tailed) of 0.000 or  $p$  value  $<0.05$ .

## DISCUSSION

Acupressure massage provide a better therapeutic effect when compared with the control group (no treatment). Acupressure massage can turn bad into good mood. The body becomes more calm so that the tension is reduced during menstruation. The impact can be reduced client depression, communicate more easily and do not easily fall into the oversensitive atmosphere.

This fact could be observe with POMS. The treatment system of TCM (Traditional Chinese Medicine) is the energy balance. When menstruation, yin energy will be reduced due to the discharge of the body. Reduction yin elements will increase the emotional feeling. Acupressure meridians in area spleen, stomach and pericardium contribute to improving energy balance during menstruation. When specific acupressure points are pressed, they create changes on two levels. On the physical level, acupressure affects muscular tension, blood circulation, and other physiological parameters. On a more subtle level that acupressure

also helps to build the body's life energy to promote healing. In fact, acupressure is based on the belief that there exists within the body a life energy called chi (*Qi*). It is different from yet similar to electromagnetic energy. Health is thought to be a state in which the chi is equally distributed throughout the body and is present in sufficient amounts. It is thought to energize all the cells and tissues of the body. Weiss-Varnan (2010), stimulation of meridian lines found in the connective tissue will deliver conduction of electromagnetic signals may start the flow of biochemistry. The process of change in brain chemistry, sensation, and the response occurs through the release of neurotransmitters and neurohormone. Energy balance in the body will increase the vitality and quality of life.

## CONCLUSION

Acupressure massage effectively improve change of mood because it makes a better mood. Increased participation in the active acupressure during menstrual periods should be done so that students are able to apply to themselves.

## References

- Andrade E, Constantino A, Julio T, Javier G, Cristina DF, Iria A, (2010). *Spanish Journal of Psychology*, 13 (1): 444-452
- Chaudhuri A, Singh A, (2012). How do school girls deal with dysmenorrhoea? *J Indian Med Assoc*. 110(5):287-291.
- Flocks C, 2008, *Atlas of Acupuncture*, München: Elsevier GmbH, pp:121-174
- Grandi, Ferrari, Xholli, Cannoletta, Palma, Romani, Volpe, Cagnacci. 2012. Prevalence of menstrual pain in young women: what is dysmenorrhea?. *Journal of Pain Research*. 5, 169-174
- Halcon LL, Editor: Snyder M dan Linquist R, (2010). *Aromatherapy dalam Complementary & Alternative Therapies in Nursing*, pp: 401-419
- Jie SK, 2010, *Ilmu Titik Akupunktur*, Singapore: TCM Publication
- Weiss-Varnan P, 2010, *Complementary & Alternative Therapies in Nursing*, Sixth Edition, New York: Springer Publishing Company, pp: 287-306
- Wong CL, Lai KY, Tse HM, (2010). Effects of SP6 acupressure on pain and menstrual distress in young women with dysmenorrhea. *Complement Ther Clin Pract*, 16(2):64-69

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

9. <http://tcmdiscovery.com/html/> Guilin Sino-western Joint Hospital Chinese Medicine Advisory Department Copyright©2003  
retrieved, at November 24 2013.



**DESCRIPTION OF KNOWLEDGE ABOUT BREASTFEEDING CONTRACEPTION  
DURING LACTATION IN MIDWIFE CLINIC OF  
MRS. MINARTI PRINGAPUS VILLAGE PRINGAPUS DISTRICT  
SEMARANG REGENCY**

**Rinta Nursanti<sup>1</sup>, Eko Mardiyarningsih<sup>2</sup>, Eka Adimayanti<sup>3</sup>  
Ngudi Waluyo Nursing Academy**

**Abstract**

*The degree of poverty will sharply increase if population growth cannot be offset by the growth rate of the economy. Family Planning Program (KB) is one of the government's efforts to cope with the rapid population growth rate. Methods of contraception should begin during the lactation period in the third post partum month in mothers who do not breastfeed because for the first month after birth, the likelihood of becoming pregnant is a little higher on the mothers who do not breastfeed. A method of contraception that can be selected by nursing mothers is the mini-pill, which contains progestin hormones, a natural and steady contraception.*

*This type of study is descriptive study using a cross-sectional approach, sample 35 respondents, the analysis used was univariate analysis. Results showed that nursing mothers knowledge about contraception during lactation was good for 18 respondents (6.3%), the category of sufficient was 15 respondents (1.95%), less category was 2 respondents (0.7%).*

*The conclusion on this study is the level of knowledge about contraceptives for nursing mothers during lactation in Midwife clinic of Mrs. Minarti in Pringapus Village, Pringapus Sub-district, Semarang category is most favorable category for 18 respondents (51.4%).*

**Keywords:** knowledge, breastfeeding mothers, contraceptives, and lactation

**Literature:** 17 literature (2003-2013)

**BACKGROUND**

The degree of poverty will sharply increase if population growth can not be offset by the growth rate of the economy. Residents will feel financial impact providing of food, education and health services (Wahyuni, 2004).

Movement KB is one of the government's efforts in tackling the problem of population. Creating a quality family 2015 vision program is a new KB, the previous is creating small family norm Happy

Prosperous (NKKBS). Welfare family is prosperous, healthy, progressive, independent, possess the ideal number of children, purposefully forward, responsibility, and duty to God Almighty (Saifuddin, 2006).

Data from the National Population and Family Planning (BKKBN) of Indonesia in 2012 showed the number of new participants in the Indonesian family planning acceptors as many as 6.152.231. The majority of Indonesian people who use contraception choose the non- contraceptive methods, or may be a long-term contraception that they choose to have short-term reactions. It can be seen from the contraceptive methods used are as many as 2.949.633 (47.94%) chose injectable acceptors; 1.649.256 (26.81%) chose the pill acceptors; 527.569 (8.58%) chose implant acceptors; 459.177 (7.46%) chose an IUD acceptors; 87.079 (1.42%) acceptor choose MOW; 17.331 (0.28%) acceptors chose MOP; 462.186 (7.51%) choose the condom acceptors. From the above data we can know that most of the total short- term contraceptive users reached 83.33%, while the long-term contraceptive users was only 16.67%.

Contraceptive method chosen by the majority of people are injectable contraceptive method with the percentage 47.94%, while the method most preferred by Indonesian society is MOP method with the percentage of only 0.51% (BKKBN, 2012).

Total Fertile Age Couple in Central Java province in the last year 2012 which became active planning participants, there were 5.287.343 participants with details of each per Injectable contraceptive method 3.007.555 (56.88%) acceptors; Pills 824,502 (15.59%) acceptors; IUD 460.128 (8.70%) acceptors; Implants 537.385 (10.16%) acceptors; MOW 289.549 (5.48%) acceptors; MOP 57.387 (1.09%) acceptors, and Condoms 110.875 (2.10%) acceptor (BKKBN, 2012).

While in Semarang district recorded in 2010 the number of family planning acceptors EFA being active as much as 15.369 participants with details

of each method CICs per 10,196 (66.34%) acceptors; pills 1,688 (10.98%) acceptors; condoms 233 (1.51%) acceptors, and IUD 2,209 (14.37%) acceptor (BKKBN, 2010).

The above data we can take an assumption that the majority of Indonesian people still want to have children again after using contraception, so they choose the short-term contraception that when they have a passion/ desire to have more children, the effects of these contraceptives can immediately removed and they can immediately perform the reproduction process to obtain offspring that they want (BKKBN, 2012).

Based on a survey conducted in BPS Ny. Minarti Pringapus Village District of Semarang District Pringapus acceptors results obtained during the year 2012 as many as 1941 EFA number of people, number of family planning acceptors among the active 1876 using 1851 total acceptor Injectable, Injectable is divided into two types, namely by using Injectable Progestin 1166 (62.15%) acceptor, and the use of Injectable with a combination of 685 (36.51%) acceptor, which uses pills 19 (1.01%) acceptor, which uses an IUD 33 (1.75%) acceptor, and the use of implants 38 (2.02%) acceptors. From the above data we can know that most of the total short-term contraceptive users reached 99.67% while the total long-term contraceptive users reached 3.77%.

Problems commonly faced by breastfeeding mothers about contraception is used for this is sometimes mothers were thinking that the use of contraception during breastfeeding will impact on the quality and production of breast milk given to children. Methods of contraception should be put into use in the third postpartum in women who are not breastfeeding. During the first month after birth, the possibility of becoming pregnant is a bit higher in non breastfeeding mothers than mothers who do breastfeed and when menstruation has occurred again, would be lower conception rates in lactating mothers compared to mothers who did not breastfeed. Contraceptive methods that can be selected by nursing mothers, among others, the mini pill, which contains progestin hormonal family planning, natural family planning, and contraception steady (Hartanto, 2004).

Family planning and contraception will also ensure that the baby gets enough nutrients for a specific time by preventing pregnancy too soon after giving birth. This is very important because breast milk is a source of nutrition and immunization is best for baby's growth and lactation also can delay fertility (Hartanto, 2004).

Results of interviews some respondents out of 10 respondents about contraception during lactation obtained 5 (50%) of respondents chose injectable contraceptive method, 3 (30%) of respondents chose the implant contraceptive methods, and 2 (20%) of respondents chose the IUD contraceptive method. From the description of some of the respondents found that each of the respondents in choosing a method of contraception during lactation only from past experience and from the explanations relating to health workers the right contraceptive method for lactating mothers. Based on this, the authors are interested in doing research on image Breastfeeding Knowledge Level About Contraception During Lactation in BPS Ny. Minarti Village Pringapus Pringapus District of Semarang District.

The purpose of this study to describe the level of knowledge about contraceptives nursing mothers during lactation in midwife clinic of Mrs. Minarti in the village while the Special Purpose Pringapus.

## METHODS

This research is a descriptive study using cross-sectional design. The population in this study is that the entire nursing mothers who have children aged 0-2 years a number of 35 nursing mothers. Sampling technique with a total sampling. The research instrument is a questionnaire previously tested the validity and reliability. Statistical analysis used univariate analysis in the form of a frequency distribution.

## RESULT AND DISCUSSION

The level of knowledge about contraception for nursing mothers during lactation was as follows Based on the results of research conducted on 35 respondents, showed respondents who had less knowledge two respondents (5.7%), having enough knowledge 15 respondents (42.9%), and who has a good knowledge 18 respondents (51.4%). This suggests that the majority of nursing mothers have good knowledge about contraceptives during lactation.

Knowledge about contraception nursing mothers during lactation in midwife clinic Mrs. Minarti is mostly good because in most of the area Pringapus nursing mothers are high school educated middleclass. The higher a person's education level of the more easily they receive information. Conversely less education will hinder the development of a person's attitude towards new values when introduced (Notoatmodjo, 2012).

Most nursing mothers in midwife clinic of Mrs. Minarti already have children so they already

know enough about contraception during lactation that had been delivered by health workers. Based on the results of related research conducted by Nur Kanifah in 2010 at An Nuur Midwife clinic in Surakarta indicate that the lactating mother's level of knowledge about contraceptives during lactation in midwife clinic of An Nuur Surakarta, obtained from a total of 36 respondents 31 respondents (86.1%) knowledgeable enough, 2 respondents (5.6%) less knowledgeable, and 3 respondents (8.3%) both knowledgeable. This suggests that the majority of nursing mothers knowledge about contraceptives during lactation in midwife clinic of An Nuur Surakarta knowledgeable enough (Kanifah, 2010).

## CONCLUSION

The level of knowledge of nursing mothers in Midwife Clinic of Mrs. Minarti Pringapus Village, Pringapus sub district, Semarang District largely in both categories is 18 respondents (51.4%). The level of knowledge of nursing mothers in Midwife Clinic of Mrs. Minarti Pringapus Village, Pringapus sub district, Semarang District in enough categories is 15 respondents (42.9%). The level of knowledge of nursing mothers in Midwife Clinic of Mrs. Minarti Pringapus Village, Pringapus sub district, Semarang District less is a category two respondents (5.7%).

## References

- Arikunto, S. (2010). *Prosedur Penelitian Suatu Pendekatan Praktik*. Jakarta: Rineka Cipta.
- Depkes RI. (2008). *Kependudukan dan Keluarga Berencana*,. [http://situs.googlegroups.com](http://situs.googlegroups.com;);, Diperoleh pada tanggal 11 April 2013.
- \_\_\_\_\_. (2010). *Kependudukan dan Keluarga Berencana*,. <http://situs.googlegroups.com>;, Diperoleh pada tanggal 10 Maret 2013.
- Handayani, S. (2010). *Buku Ajar Pelayanan KB*. Yogyakarta: Pustaka Rihama.
- Hartanto, H. (2004). *Keluarga Berencana dan kontrasepsi*. Jakarta: Pustaka Sinar Harapan.
- Hidayat, A.A. (2009). *Metode Penelitian Kebidanan Dan Teknik Analisa Data*. Jakarta: Salemba Medika.
- \_\_\_\_\_. (2010). *Metode Penelitian Kebidanan Dan Teknik Analisa Data*. Jakarta: Salemba Medika.
- \_\_\_\_\_. (2011). *Metode Penelitian Kebidanan Dan Teknik Analisa Data*. Jakarta: Salemba Medika.
- Noerdin, M. (2003). *Prinsip-Prinsip Dasar Ilmu Kesehatan Masyarakat*. Jakarta: Rineka Cipta.
- Notoatmodjo, S. (2007). *Ilmu Kesehatan Masyarakat*. Jakarta: PT Rineka Cipta.
- \_\_\_\_\_. (2012). *Metodologi Penelitian Kesehatan*. Jakarta: PT Rineka Cipta.
- Nursalam. (2003). *Konsep Dan Penerapan Metodologi Penelitian Ilmu Keperawatan Pedoman Skripsi, Tesis, dan Instrumen Penelitian Keperawatan*. Jakarta: Salemba Medika.
- Proverawati, A. (2010). *Panduan Memilih Kontrasepsi*. Yogyakarta: Nuha Medika.
- Riwidikdo, H. (2009). *Statistik Penelitian Kesehatan*. Yogyakarta: Pustaka Rihama.
- \_\_\_\_\_. (2010). *Statistik Penelitian Kesehatan*. Yogyakarta: Pustaka Rihama.
- Saifuddin, A.B. (2010). *Buku Panduan Praktis Pelayanan Kontrasepsi*. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo.
- Setiadi. (2013). *Konsep Dan Praktek Penulisan Riset Keperawatan*. Yogyakarta: PT Graha Ilmu edisi ke 2.
- Setyaarum, D.N. (2011). *Panduan Lengkap Pelayanan KB Terkini*. Yogyakarta: Numed
- Bobak dkk. 2004. *Buku Ajar Keperawatan Maternitas*. Edisi 4. Jakarta: EGC.
- Sulistiyawati, A. (2011). *Pelayanan Keluarga Berencana*. Jakarta: Salemba Medika.
- Wahyuni. (2004). *Pertumbuhan Penduduk*. <http://www.medika.journal.co.html> Diperoleh pada tanggal 10 Maret 2013.
- Wikjosastro, H. (2008). *Ilmu Kebidanan*. Jakarta: Yayasan Bina Pustaka Sarwono Prawirohardjo.
- Profil Kesehatan. (2010). Peserta KB Baru Menurut Kumulatif Metode Kontrasepsi 2012,. <http://www.BKKBN.go.id>;, Diperoleh pada tanggal 15 Maret 2013.
- \_\_\_\_\_. (2012). Peserta KB Baru Menurut Kumulatif Metode Kontrasepsi 2012,. <http://www.BKKBN.go.id>;, Diperoleh pada tanggal 15 Maret 2013.

## THE DEVELOPMENT OF INTEGRATIVE MEASUREMENT MODEL OF PATIENT SAFETY CLIMATE OF HOSPITAL IN DKI JAKARTA, 2013

<sup>1</sup>Rachmawati, Emma., Linda, Onny., Fikri. Ipik M., Prita Dewi, Evindiyah.

<sup>1</sup>University of Muhammadiyah Prof DR HAMKA (UHAMKA) Jakarta, Indonesia

### **Abstract**

*The integrative model in measurement of patient safety climate is currently developing and routinely performing in many countries as one of the performance indicators of patient safety in hospitals. This research aimed at developing the model in Indonesia with the good value of psychometric.*

*The development of the model based on a measurement model of patient safety climate by Rachmawati (2012) which has been applied in some private hospitals in Indonesia. The new indicators of the model explored through the review of the latest journal and rules, semi structured interviews with 5 (five) patient safety experts, and 5 focus group discussions consisting of staff and management of various kinds of hospital in Jakarta. The indicator gained examined in terms of content and language ("bahasa") as well as the value of Alpha Cronbach..*

*Results of the study revealed that the base model still used for its nature as an integrative measurement and has a good psychometric value (RMSEA=0.047, close fit). It is also gained 25 new indicators consisting of 5 indicators at unit level ("teamwork"), 3 indicators at individual level ("individual consciousness"), 17 indicators at hospital level ("patient safety climate") which are also reliable (with  $\alpha$ -cronbach > 0.70).*

*This integrative model is recommended to be applied further so as to provide a more detailed condition of patient safety climate in hospital in DKI Jakarta.*

**Keywords:** Patient Safety Climate, Measurement Model

### **BACKGROUND**

Patient safety is the basic principle of health service and critical components of quality management in hospital (WHO, 2004). At the national level, the issue of patient safety is becoming an important part of international hospital accreditation (JCI) and instruments have been drawn up Patient Safety Handbook (2<sup>nd</sup> edition, 2008) and Standard of Patient Safety on Hospital (2013). The focus of Patient Safety (PS) is closely

related to the still high number of incidents of PS, particularly Adverse Event (AE). At national and global level, the number of AE is known in various countries ranging from 3-16% (WHO, 2004), or 2.5-16.6% (Vincent, 2005 in Raleigh, 2009), and almost 50% of which are preventable occurrences (Smits, et al, 2008).

Efforts to suppress the occurrence of incidents of AE are mostly done through, among others, the cultural approach. The cultural approach is made, because it is believed that "the most fundamental barrier to improving the safety of patient care is the culture of the health organization" (Castle, 2006). According to NPSA (National Patient Safety Agency); also underline the importance of climate such this in WHO Reports (2006), European Commission in 2005 and the Council of Europe (2006) (Heillings, et al, 2007). Even in USA, since 2007, JCAHO (Joint Commission on Accreditation of Healthcare Organization) routinely has done annual judgment against the PS climate or culture such as the target of PS in a hospital. In Indonesia, "build or create a culture of PS," was placed in a first step from "7 steps towards PS." The results of the measurement of culture/climate of PS are important as the alternative performance indicators of safety in an organization (Guldenmund, 2000). Evaluation of safety culture is growing not only based on the presumption that technical failure as the cause of an accident, but is more focused on predictive measures of behavior management, safety systems and the perception of the entire staff to the safety (Colla, et al., 2005)

There are various models of climate or culture KP measurements in various countries, which generally have high psychometric values, as well as have a variety of dimensions/valid constructs that build it. Several countries do a model of adjustment in accordance with the situation and conditions of culture/climate of health care in their countries respectively, e.g. Japan, Netherlands, New Zealand, United Kingdom, China, etc. In Indonesia, there has been no information about the measurement model culture/climate of PS, who indeed made specifically according to the Indonesian hospital cultural setting, especially in Jakarta, which can almost be called a good picture representing the diversity of

the hospital that exist in many big cities in Indonesia.

## METHOD

The development of the model based on an integrative measurement model of patient safety climate by Rachmawati (2012) which has been applied in some private hospitals (owned by faith based organization called “Muhammadiyah” in Indonesia). This model had a good value in psychometric ( $RMSEA=0.047$ , close fit).

The new indicators of the development model explored through the review of the latest journal and rules (JCI, Phipps et al., Listyowardoyo et al., KOMite KPRS (2009-2013)); semi structured interviews with 5 (five) patient safety experts in Indonesia; and 5(five) focus group discussions consisting of staff and management of various kinds of hospital in Jakarta (RSUP Fatmawati, RSI Sulianti Suroso, RS, RSP Atmajaya, etc).

The indicators gained examined in terms of content and language; its importance to measure the culture of PS; whether confusing (could be interpreted differently by respondents); difficulties to understand its language; its accordance with the conditions of the hospital, and respondents less information to answer this question. Last, the detailed of instrument tested on the value of  $\alpha$ -

Cronbach obtained. The conceptual framework of the integrative model is as follows:

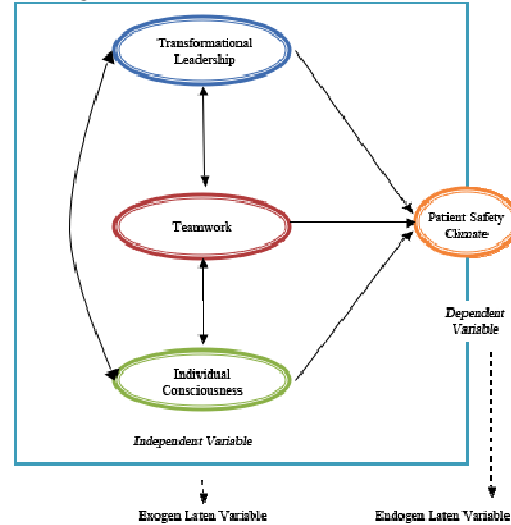


Figure 1.

Based Model of this research is the structural and measurement model of Patient Safety Climate by Rachmawati (2012) (see Figure 2).

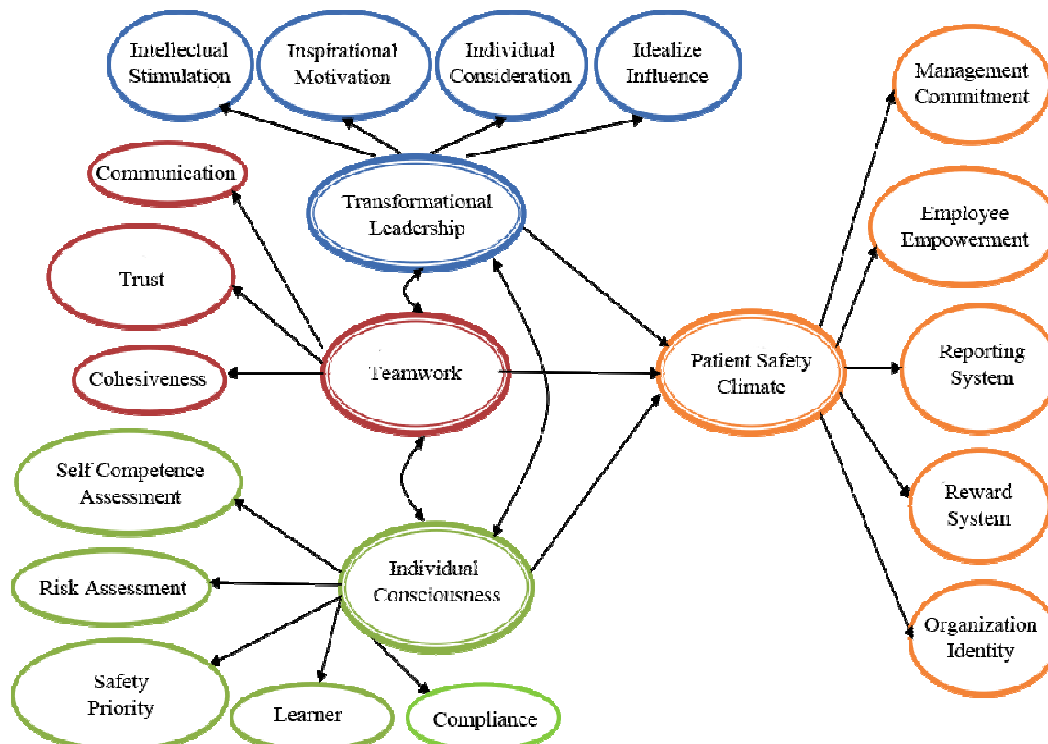


Figure 2. Structural and Measurement Model of Patient Safety Climate (Rachmawati, 2012)

## RESULT AND DISCUSSION

Results of the study revealed that the based model by Rachmawati (2012) still used for its nature as an integrative measurement (in 4 level of measurements: Top management/CEO, Work Unit, Individual and Hospital) and has a good psychometric value (RMSEA=0.047, close fit). It has been proved that the model could well-described the conditions of patient safety climate at each level in each of the hospital which became a sample research. The result of this model also showed that the "Leadership" variable of the Senior Management of hospital or CEO had the highest directly impact in building the patient safety climate (SLF=0.56). This result is similar to the results obtained from the research carried out by Mc Fadden et.al (2009) in a Model of Path Analysis of Transformational Leadership, Culture of PS, the Efforts of PS and Outcomes of PS. There is no additional indicator for this variable (transformational leadership) in this development model of measurement. This variable (Transformational Leadership) consists of 4 indicators: "inspirational motivation, intellectual stimulation, individualized consideration and idealized of influence." (based on Kreitner & Kinicky, 2007).

This research gained 25 new valid and reliable items consisting of 5 indicators at unit level ("teamwork"). The "teamwork" variable consist of 3 indicators, which are "Trust", "Communication" and "Cohesiveness," and described with 5 additional items as follows:

1. There was a problem of communication between employees ...
2. Our unit trust against other units ...
3. Employees in this unit are highly enjoyable...
4. There is a pattern of good cooperation between the various health workers ...
5. A mismatch between employees in the unit is resolved well ...

The addition of the items above can possible add to the accuracy of the measurement of indicators of teamwork on the based model, which only gives the lowest direct impact in building the climate of KP (SLF= 0.07, Rachmawati, 2012). PS is a team effort, the team that did not effectively works will create many opportunities for the occurrence of mistakes/errors (Merry&Brown in Byers& White, 2004).

The variable of Individual Consciousness consists of 5 indicators, which are "Competence, risk assessment, safety priority, Learner, and Compliance." There are 3 new reliable and valid

items gained at individual level ("individual consciousness") as follows:

1. I understand very well the risk of any negative impact from an error/incident ...
2. Health workers in the shift turnover of RS is still an issue ...
3. The most senior staff know everything so that ...

Individual consciousness is widely used as a valid indicator to measure the PS culture/climate in some surveys as Naveh et al (2005), Matsubara et al. (2008), Singer et al. (2009), etc.

Last, there are 17 reliable and valid items gained at hospital level ("patient safety climate"). This variable consists of 5 indicators which are "the management commitment, employee empowerment, reporting system, reward system and organizational identity." Some of the additional items are:

1. There is a problem in the disbursement of the budget ...
2. The allocation of the financial budget of RS is not appropriate (smaller)...
3. Employees who have experienced or are learning less given training about...
4. Employees are afraid of getting a warning letter if she reported the incident...
5. Hospital's priority on patient safety because patients already pay expensively...
6. etc...

Most of indicators above used in many measurement models of PS climate in various countries, especially for "identity organizational identity which is important variable to make intervention program of PS work effectively. We gained many new items according to the result from the interviews and focus group discussion, which adjusting with some characteristic of local hospital culture.

## CONCLUSION

The new integrative measurement model of patient safety climate obtained has also good psychometric values and need to be applied further so as to provide a more detailed condition of patient safety climate in hospital in DKI Jakarta.

## References

- Byers JF & White SV. 2004. *Patient Safety, Principles and Practice*. USA: Springer Publishing Company, Inc.
- Castle NG. 2006. Nurse Aide's Ratings of The Resident Safety Culture in Nursing Homes. *International Journal for Quality in Health Care*; Volume 18, Number 5: pp.370--376.

- Colla, J.B, Bracken, A.C. Kinney, L.M., & Weeks WB. 2005. Measuring patient safety climate: A review of survey. *Qual Safe Healthcare*, 14, 364-366
- Flin R. 2007. *Measuring Safety Culture in Health Care: A Case of Accurate Diagnosis*. USA: Elsevier Inc.
- Guldenmund, F. W. 2000. Perceptions of patient safety culture in six Canadian healthcare organizations, final report prepared from a grant from Canadian Patient Safety Institute (CPSI). *Patient Safety Culture Research at York University*.
- Heillings J., Schrooten W., Klazinga N., & Vleugels A. 2007. Challenging Patient safety culture: survey results. *International Journal of Healthcare Quality Insurance*. 7, 620-632
- Joint Commission International (JCI). 2006. *Patient Safety, Essentials for Health Care, International Edition*. USA.
- Joint Commission International (JCI). 2010. *Accreditation Standards for Hospitals*. 4<sup>th</sup> edition. JCI. USA
- Komite Keselamatan Rumah Sakit (KKP-RS). 2007. *Pedoman Pelaporan Insiden Keselamatan Pasien (IKP)*. Jakarta: PERSI.
- Matsubara S, Hagihara A, Nobutomo K. 2008. Development of a Patient Climate Scale in Japan. *International Journal of Quality in Health Care*, Volume 20, Number 3: pp: 211--220.
- Mc. Fadden KL, Henagan SC, Gowen CR. 2009. *The Patient Safety Chain: Transformational Leadership's Effect on Patient Safety Culture, Initiatives, Outcomes*. USA: Elsevier Inc.
- Moeljono, Djokosantoso. 2005. *Cutured, Budaya Organisasi dalam Tantangan*. Jakarta: PT Elex Media Komputindo.
- Naveh, E, Katz-Navon, T., & Stern, Z. 2005. Treatment Errors in healthcare. A safety climate approach. *Journal of Management Science*. Vol 51, Number 6, 948-960.
- Phipps, Denham., L. Jolanda de Bie. Hanne Herborg et al. *Evaluation of the Pharmacy Safety Climate Questionnaire in European Community Pharmacies*. International journal for Quality in Health Care 2012; Volume 24, Number 1; pp. 16-22. Advance Access Publication. Oxford University Press. UK.
- Rachmawati, Emma. *Model Pengukuran Iklim Keselamatan Pasien di RS Muhammadiyah 'Aisyiyah, tahun 2012. Disertasi*.
- Raleigh VS, Cooper J, Bremner SA, Scobie S. 2008. Patient Safety Indicators for England from Hospital Administrative Data: Case-Control Analysis and Comparison with US Data. USA: bmj.com. *BMJ*; 337; a1702.
- Rozovsky FA, & Woods JR, Jr. 2005. *The Handbook of Patient Safety Compliance, A Practical Guide for Health Care Organization*. USA: Jossey- Bass.
- Singer SJ, et al. 2003. Park KC. The Culture of Safety: Result of an Organization-Wide Survey in 15 California Hospital. USA. www.qshc.com. *Qual Saf Health Care*: 12; 112--118.
- Sorra J & Nieva V. 2004. *Hospital Survey on Patient Safety Culture*. USA: AHRQ Publication. September.
- Listyowardojo., Tita Alissa, Raoul E. Nap, and Addie Johnson. 2011. *Variations in Hospital Worker Perceptions of Safety Culture*. International journal for Quality in Health Care 2012; Volume 24, Number 1; pp. 9-15. Advance Access Publication. Oxford University Press. UK.
- Youngberg BJ & Hatlie MJ. 2004. *The Patient Safety Handbook*. Canada: Jones and Bartlett Publishers, Inc.

## THE MODEL OF GLUCOSE FLUCTUATION WITH DIABETES BASED ON MAPPING HbA1c AND MEAN AMPLITUDE OF GLUCOSE EXCURSION VALUE

**Lailis Syafa'ah<sup>1</sup>, Rasad Indra<sup>2</sup>, Budi Santoso<sup>3</sup>, Askandar Tjokro Prawiro<sup>4</sup>**  
<sup>1,3</sup> Technique Faculty Electronic Department Muhammadiyah University Malang  
Jl. Raya Tlogomas No. 246 Telp. (0341) 464318 Malang 65144,  
e-mail: lailis\_tsd@yahoo.co.id, budisanto.ypm@gmail.com  
<sup>2,4</sup> Medical Faculty Brawijaya University  
Jl. Veteran Malang 65145, e-mail: rindra@yahoo.com

### Abstract

*Glycemic variability or MAGE (Mean Amplitude of Glucose Excursion) is an important parameter that used to solve clinical problems and is highly related with oxidative stress. Along with other parameters such as HbA1c, Fasting Plasma Glucose, and Postprandial Glucose, this parameter may indicate macro and microvascular complications in diabetes. However, this parameter can only be measured if the measurement of glucose level performed continuously for 3-4 days.*

*Therefore, the aim of this study is to develop a technique for continuous measurement of blood-glucose that result a fluctuation pattern which is integrated with the measurement of HbA1c and MAGE. For this purpose, this study was divided into three phases. Firstly, the identification and screening of diabetic patient through medical record and continuous measurement; secondly, the computation process by utilizing signal processing; and finally, the mapping of pattern based on HbA1c and MAGE level using Artificial Intelligent (AI) technology and k-nearest neighbor (K-NN) algorithm. All of these processes will result the fluctuation pattern of blood glucose level based on HbA1c and MAGE mapping.*

**Keywords:** Diabetes, MAGE, HbA1c, K-Nearest Neighbor

### BACKGROUND

Patients with diabetes mellitus (DM) in the world is around 347 million people, and estimated 3.4 million people died in 2004 from consequences of high sugar levels in their blood. WHO estimates that diabetes become the 7th main causes of death in 2030.

Indonesia was ranked ninth with 7.6 million people suffer from diabetes and it is estimated that by 2020 it will further increase rankings, up to sixth ranked [1].

DM disease is a group of metabolic diseases with characteristic hyperglycemia that occurs due to abnormal insulin secretion, insulin action, or both [1]. Glucose levels in normal people generally stable, but may vary or called glycemic variability in people with diabetes. Glycemic variability has contributed to complications in patients with DM [6][3].

MAGE (Mean Amplitude of Glucose Excursion) is an important glycemic variability parameter. It used to solve clinical problems and will result in oxidative stress as well as having the potential to contribute to the development of macro and microvascular complications in diabetes. Other three parameters (Glucose Triad), namely:

*HbA1c, reflecting glucose levels in the past three months according to the age of the human red blood cell, and is approximately 100-120 days where treatment target > 7%.*

*Fasting Plasma Glucose, and Postprandial Glucose (after eating).*

MAGE can be measured if the measurement of glucose fluctuation performed continuously for 3-4 days and in one day was measured for a minimum of seven times [2] by using equation (1) [4].

$$MAGE = \sum \frac{\lambda}{x} \dots\dots\dots (1)$$

where :

$\lambda$  is the absolute difference value between the upper and lower peak glucose

$x$  is the number of measurements.

Equation (1) need a continuously glucose measurement using CGM (Continuous Glucose Monitoring) as a requirement, because CGM allows glucose patterns configuration detection in several metabolic conditions.

However, due to technical reasons, CGM measurements can not be applied in most conditions especially on development country regions. Then the measurements are made with



non-continuous technique and produces discrete data.

The approachment to the continuous data performed by data interpolation, that is a way to search for the values between some data points which known, to approximate a function defined by the data from the measurement results instead of

defined as a formula. Data interpolation also applied for digital image processing, contour making, and useful in the recovery process with close to CGM results. DM patients who have a low MAGE value indicates stable control of their glucose (F. John Service, 1980).

$$p(x) = a_n x^n + a_{n-1} x^{n-1} + \dots + a_2 x^2 + a_1 x + a_0 \dots \quad (2)$$

where :

$p(x)$  is polynomial interpolation function

$a_n$  is polynomial coefficients, and

$x$  is the point where the new value will find out

There are two important aspects in the MAGE calculation. First, MAGE is not considered significant excursion frequency –but only the average amplitude-and second, MAGE is not consider whether glycemic excursion is outside the normal range.

Uncontrolled diabetes mellitus is associated with several long-term complications that contribute to increased mortality (J. Hans DeVries, 2013). The pathogenesis of this complication is complex and involves multiple mechanisms, with the chronic hyperglycemia become a main contributor. Currently, the glycemic variability and oxidative stress induction role in the pathogenesis complication become interested subject to study.

By controlling the glycemic variability, it is possible to reduce this complication and assign therapy for all diabetes patients. With continuously tight glucose control, can be reducing morbidity and mortality not for patients with diabetes only but also non-diabetics who become non fixed hyperglycemic. Recent MAGE calculations as mentioned above, are not used in routine clinical usage and has not been integrated with the measurement of blood sugar [5][7]. MAGE calculations on those research studies are not integrated yet and using manual methods, although glucose measurement is performed continuously (CGM).

In this research, a system which able to make a machine (computer) doing the job as good as performed by human being, has been made with a given stock of knowledge and have the ability to make reasoning. Through learning techniques by KNN algorithm, this system is an integrated measurement development of glycemic variability with continuous glucose monitoring (CGM-interpolation). It also facilitates the management of routine clinical usage and has the potential to be an important measure in overall glucose control. This system expected to function as a predictor of the complications risk of diabetes which are not detected by the level of glycosylated hemoglobin (HbA1c).

Data pattern analysis of the the patients, based on a graph formed from the curve interpolation method. Results of polynomial interpolation are grouped (clustered) based on the form of graphs glucose curve pattern with the graph features extraction using k-NN (k Nearest Neighbor) algorithm. Information overview of fluctuation level patterns in blood sugar will shown at the polynomial curve fitting process. Through the learning system, data that has been defined and used as a model of the data pattern, will be obtained grouping of HbA1c levels by Perkeni (Indonesian Endocrinology Group) standard and calculated MAGE. This based modeling grouping results enables referenced efforts to prevent or slowing down the development or further complications.

## METHOD

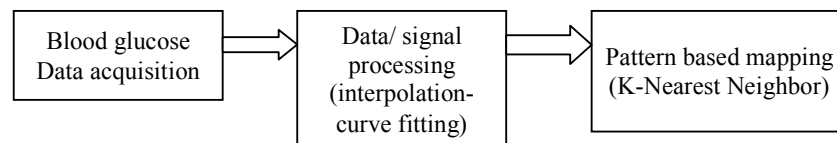


Figure 1. Diagram of system

This research is a theoretical analysis explores the pattern refers to the fluctuations of blood

glucose resulting from physiological events during meals (breakfast, lunch and dinner) to utilize

glucose monitoring devices. Output of the sensor (strip) is sent through a pattern transmitter to monitor fluctuations in blood sugar levels within a day 3-4 days measured seven times (before and after breakfast, before and after lunch, before and after dinner and before sleep) and stored in a memory and can be downloaded to a computer for further processing.

This data is in the form of discrete data, to determine the model of glucose fluctuations must be converted to discrete data using a continuous data interpolation approach, next the K-NN algorithm fluctuation patterns can be classified (clustering) so that it can describe the pattern of fluctuations in blood sugar levels based on HbA1c levels and glycemic index variable (MAGE).

### Subjects of Research

Population target in this study are patients with diabetes type 2 stratified by HbA1c level according to PERKENI criteria. There are five groups of DM management algorithm by PERKENI, but in this study only using two groups, HbA1c <8.5 and HbA1c >8.5.

Population and research subjects are the subjects according to the study criteria :

- Have a normal body mass index, which is 18.5 to 25.0
- Pathological subjects DM, which has blood glucose levels as  $\geq 200$  mg/dl, fasting blood glucose levels  $\geq 126$  (Perkeni, 2011)
- Approved by doctors for glucose measurement.
- Volunteered to be subjects for the study measured the blood glucose level signed consent (informed consent) and cooperative during the investigation.

From thirty study subjects divided into 2 criteria based on HbA1c levels with treatment target <7% (Perkeni, 2011), 9 definitive subjects are taken for training and others for testing as the input of K-NN.

## RESULT AND DISCUSSION

### Identification and Screening

Identification and screening of people with diabetes through medical records and random glucose measurements as subjects whose blood sugar level above normal ( $> 200$  mg / dl). Subjects which identified as DM patient measured seven times a day on three days using Glucometer Accu Chek Performa nano with 99% accuracy. Data retrieval results in xls file then converted into a CSV file with two parameters : time (minutes) and glucose levels (mg/dl).

In this study, there are two kinds of data : Sweden (continuous) and Indonesian (discrete).

Sweden datas used in firsts stage to find patterns and fluctuations as early models. While the Indonesian data used for interpolation methods to generate continuous data approachment, then calculate the value of HbA1c, MAGE, and polynomial curve fitting process.

### Mapping Pattern Based HbA1c and MAGE

Pattern mapping of patients based on glucose data retrieval which has been mentioned in the previous section will be input to the K-NN. Each calculation HbA1c and MAGE caused grouping of data and statistical analysis produces parameter max, min, mean and norm of residuals. Norm of residuals obtained from the proximity distance curve fitting graph to the original data and indicate the level of fluctuations interpolate the original curve. The greater the residual value of the norm of the higher volatility curve.

### The Results

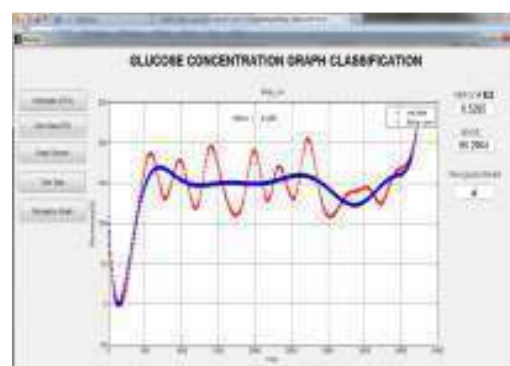
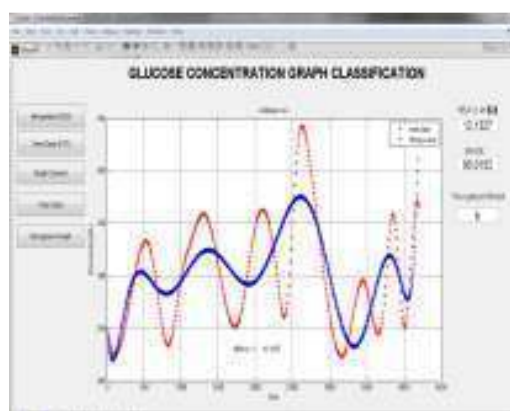
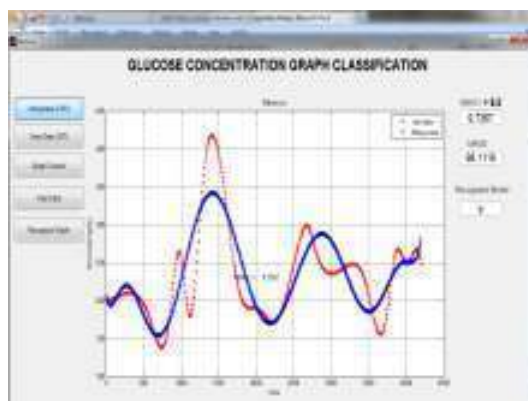


Figure 2  
Glucose Graph Pattern with HbA1c <8,5



(a)



(b)

Figure 3

Glucose Graph Pattern with HbA1c >8,5

Results from this research is a pattern that has been classified into two groups based on HbA1c value and MAGE value. Group A has a value of HbA1c <8.5 as shown in Figure 2 and group B HbA1c > 8.5 as shown in Figure 3.

Figure 2 shown that MAGE value will be high when there is a high fluctuation as shown is 98 mg/dl, although the value of the treatment target of HbA1c approaching normal price HbA1c <7%, suggesting control in patients with DM stable.

In Figure 3 at value of HbA1c > 8.5 indicates a high MAGE value: at image a) HbA1c = 12.1% MAGE value = 90 mg/dl, image and b) HbA1c = 9.7% and the value of MAGE = 98 mg/dl

## CONCLUSION

Based on observation and testing was concluded :

- Glucose Measurement with the discrete or non-continuous (making glucose for three days and seven times per day), can describe as pattern of glucose excursions with interpolation methods and become the development of existing measurement techniques.
- The Continuous Glucose Measurement of glucose fluctuation pattern can be grouped by HbA1c

levels and the value of the MAGE using K-Nearest Neighbor algorithm (K-NN).

- Fluctuating glucose levels can increase the value of MAGE.
- The tendency is no relationship between HbA1c levels with MAGE, HbA1c value is directly proportional to HbA1c.
- Control DM patients a trend of lower stable value MAGE.

## References

- American Diabetes Association. 2010, *Position statement: Standards of Medical Care in Diabetes 2010*. *Diab Care*, 33 (1).
- Cynthia R. Marling, Ph.D., Jay H. Shubrook, D.O., FACOFP, Stanley J. Vernier, M.S., Matthew T. Wiley, B.S., Frank L. Schwartz, M.D., FACE, 2011, *Characterizing Blood Glucose Variability Using New Metrics with Continuous Glucose Monitoring Data*, *Journal of Diabetes Science and Technology*, 5 (4), 871-878.
- David Rodbard M.D, 2011, *Glycemic Variability: Measurement and Utility in Clinical Medicine and Research—One Viewpoint*, *DIABETES TECHNOLOGY & THERAPEUTICS*, 13 (11).
- F. John Service, 2013, *Glucose Variability*, *Diabetes*, 62, 1398-1404.
- Klaus-Dieter Kohnert, Lutz Vogt, Eckhard Salzsieder, 2010, *Advances in Understanding Glucose Variability and the Role of Continuous Glucose Monitoring*, *European Endocrinology*, 6 (1), 53 – 56.
- Monnier L., Colette C., 2008, *Glycemic variability: should we and can we prevent it?*, *Diabetes Care*, 31(2), 150–154.
- Renata A. Rawlings, Hang Sh B.S., Lo-Hua Yuan, William Brehm, M.S, Rodica Pop-Busui, M.D., Patrick W. Nelson, 2011, *Translating Glucose Variability Metrics into the Clinic via Continuous Glucose Monitoring: A Graphical User Interface for Diabetes Evaluation (CGM-GUIDE)*, *DIABETES TECHNOLOGY & THERAPEUTICS*, 13 (12), 1241-128.

**THE EFFECT OF HIGH ENEMA TO DECREASE BLOOD UREUM LEVEL OF  
CHRONIC RENAL FAILURE PATIENTS OF PROF. DR. MARGONO SOEKARDJO  
PUBLIC HOSPITAL PURWOKERTO**

**Made Suandika**

**Abstract**

**Background:** Chronic renal failure is a disorder function of renal with increase of ureum level in the blood. the therapy of this disease today is by used dialisa ( hemodialisys and peritoneal dialisys) which needed expensive cost. Thus, its very necessary to found new method for decrease the ureum level. As specialy lavement therapy.

**Objectives:** This study aimed to know about the effect of High enema to decrease the blood ureum level of chronic renal failure patients.

**Method:** This study used quasi experiment with pre test and post test with control group design. The cronic renal failure patient took with purposive sampling teknics consist of 15 person for control and 15 person for treated group. T-test was applied to analyze the data.

**Result:** The average of blood ureum level before and after treated by 3 days High Enema are 257,40 and 355,98 respectively. Thus the average of blood ureum level before and after in control group are 353,86 and 398,97 respectively. Base on the t-test the difference of blood ureum level before and after treated by 3 days High Enema, found that t value was 0.309 ( $p = 0.003$ ). Thus the difference of blood ureum level before and after 3 days in control group, found that t value was -2.157 ( $p = 0.025$ ). That's mean the High Enema has an effect to decrease the blood ureum level of chronic renal failure patients significantly.

**Conclusion:** The High Enema has an effect to decrease the blood ureum level of chronic renal failure patients

**Keywords:** High Enema, blood ureum level, chronic renal failure.

**BACKGROUND**

Chronic renal failure is a disorder that runs chronic renal physiology of normal kidney function started to not work anymore. Chronic kidney disease is an important public health problem because according to reports the data derived from patients with chronic renal failure who had been treated in hospital Kariadi 1983 until June 1993 stating 80% of patients are of childbearing age (Parsoedi 1994). This condition may hamper the

quality of life and productive capabilities in addition to inhibiting development in general.

Globally more than 500 million people have chronic kidney disease. Approximately 1.5 million people live must rely on dialysis. While in Indonesia alone, there are currently about 70 thousand patients with chronic renal failure requiring dialysis. However, this figure does not reflect the true state (Raharjo, 2001).

It is known that inadequate action will increase the mortality of hemodialysis. In the United States patients who undergo hemodialysis measures 22-24%, in Japan and in Europe 10-15%. The issue becomes very important because the mortality of chronic kidney disease regular hemodialysis continues to rise, such as in the United States in 1981 mortality was 21.0% and 24.3% in 1988. As a result of inadequate hemodialysis caused huge material losses and unproductive the regular hemodialysis patients (Peterson, 1995).

In chronic renal failure the data will be found on examination in the laboratory, namely blood urea levels tend to be high. This can occur due to the setting of renal function as disturbed balance in the blood urea. Because the kidneys are not able to discharge urea produced from the breakdown of ammonia in the hearts of the urea levels in the blood will be higher so that the uremic syndrome, which is characterized by itching, nausea, vomiting, dizziness and shortness of breath patients may experience excessive (Suhardjono, 2001).

Production of excess ammonia from the breakdown of proteins in the human digestive ie the most frequent bowel bacterial nitrogen will affect the levels of urea in the blood. Ammonia is highly toxic and harmful to the body will be compensated for conversion to urea in the liver. Due to the nature of urea soluble in water will follow the blood flow to the kidneys. Furthermore, in the kidney urea will be issued in the form of urine. Under normal circumstances there is a bit of ammonia in the blood, the concentration ranges from 10 to 50 mg/100ml. Levels of ammonia is quickly removed from the blood and into urea in the liver. However, in contrast to patients who have chronic renal failure, namely the kidneys to remove urea in the

blood was not optimal so that the levels remain high in the body (Suhardjono, 2001)

The resulting ammonia can cause coma when they are spread more into the brain. Ammonia in the body is highly toxic raw materials of urea. The decrease of the ammonia production should be done as quickly as possible in a way that minimize risk to the patient. Decreased levels of ammonia will be followed by decreased levels of urea in the blood as well. If renal failure in patients who do not qualify for hemodialysis as most often found in the anemic patient will wait for transfusion first blood. In such patients are at risk of blood urea levels will be higher and could endanger patients. Independent nursing actions such as high enema is action when such action can reduce levels of ammonia in the digestive tract (colon), if done correctly and programmed. Seeing these problems important nursing action is high enema to cleanse the digestive tract that aims to reduce levels of ammonia produced in the gastrointestinal tract before absorption into the blood (Endeton, 1985)

#### METHODE

This research is a quantitative experimental in vitro by treatment directly to the sample. Where researchers want to know how much influence the risk of a decline enema blood urea levels in patients with Chronic Renal Failure. This study used a pre-post test design with control group design consists of two groups: the control group and the treatment group. Most of the samples were used as a control intervention given high enema action. Urea concentration measurements made before and after the intervention

The population in this study come from all patients with chronic renal failure in the Rose room R. Prof. DR. Margono Soekardjo Hospital in Purwokerto. Total incidence of chronic renal failure in the Rose room Prof. DR. Margono Soekardjo Hospital from September to November 2011 was 88 patients.

Researchers assume that members of a homogeneous population of patients with chronic renal failure. Where samples are in accordance with the inclusion criteria.

Samples were taken at random (random) which consists of 30 samples, and 15 samples were used as control samples and 15 other high enema action.

**Inclusion criteria:** Chronic Renal Failure Patients with a good general state of consciousness compos mentis, Levels of blood urea over the normal limits (10-50 mg/100ml), Aged 18-50 years, Blood hemoglobin levels of at least 10 g%, Chronic

Renal Failure Patients who did not experience respiratory problems, Chronic Renal Failure Patients who undergo hemodialysis 1 week, Chronic Renal Failure Patients who agreed to do the action of high enema

**Exclusion criteria:** Patients with chronic renal failure who undergo liver dysfunction, Chronic Renal Failure Patients with congestive heart failure, Chronic Renal Failure Patients who disagrees high huknah action, Chronic Renal Failure Patients experiencing dispnue, Chronic Renal Failure Patients who recatal carcinoma, colon carcinoma, sigmoid carcinoma.

#### RESULT AND DISCUSSION

**Comparison of Pre urea levels in the treatment group and the Pre urea levels in the control group in patients with Chronic Renal Failure.** From the calculation of the Independent t-test analysis found the p-value was 0.970. The p-value is greater than the value of  $\alpha$  (5%). These results indicate that there is no significant difference between the levels of blood urea in the group treated with the Pre levels of blood urea Pre in the control group in patients with Chronic Renal Failure. Blood urea levels in patients with Chronic Renal Failure has an average mean value of 355.98 mg/100 ml and urea levels before enema the controls had an average value of 353.87 mg/100 ml. This shows that the levels of urea in the treatment group before given high enema greater than the urea levels in the control group by mg/100 ml.

**Comparison of blood urea levels in the group treated with the Pre levels of blood urea Post 3 days in the treatment group in patients with Chronic Renal Failure.** From the calculation premises pair t-test analysis obtained value of  $t = 0.309$  ( $p = 0.003$ ). p-value less than the value of  $\alpha$  (5%) or 0.005 means that  $H_0$  is rejected and  $H_a$  accepted. These results indicate that there are differences in levels of blood urea before being given a high enema with blood urea levels after 3 days enema higher in the treatment group were significant. Blood urea levels in patients with Chronic Renal Failure before high enema action has an average value of 355.98 mg/100ml whereas urea levels after high enema action for 3 days which has an average value of 257.40 mg/100 ml. This shows a decrease in the levels of urea are large enough that as many as 98.58 mg/100 ml. High enema action in this study performed a total of 1 times a day. Examination of blood urea levels after high enema action was repeated at intervals of 10 to 12 hours which aims to evaluate the effect of high enema action against the patient's blood urea

levels. As for evaluating the patient's overall action levels of blood urea examination on the third day post enema action high so this study is enough to get maximum results. Enema is a solution that is inserted into the rectum and sigmoid colon function is to remove feces and flatus and this action will be able to reduce intestinal fermentation so it is possible this is what causes the decrease in blood urea levels in patients with renal failure chronic. This happens because of the high enema working through the intestinal fermentation mechanism so as to minimize the levels of ammonia in the body. This forms the basis of ammonia to stimulate increased levels of urea in the blood so that when ammonia lower the levels of urea in the blood becomes decreased. This is thought to be the cause of the decline in the levels of urea in the blood after the action of high enema.

**Comparison of blood urea levels in the control group with the Pre levels of blood urea Post 3 days in the control group in patients with Chronic Renal Failure.** Pre urea levels in the control group had an average value of 353.86 mg/100 ml and the mean value of blood urea levels 3 days control was 398.67 mg/100 ml. This shows the huge increase is as much as 44.81 mg/100 ml, while based on statistical calculations using pair t-test Samples obtained value  $t = -2157$  ( $p=0.025$ ). This suggests that there are differences in levels of blood urea Pre in the control group with levels of blood urea Post 3 days in the control group significantly.

**Comparison between urea levels after 3 days with 3 days after control in patients with Chronic Renal Failure.** Blood urea levels in patients with Chronic Renal Failure after high enema action for 3 days to get an average value of 257.40 mg/100ml different from the results of urea levels after 3 days on a control that has an average value of 398.67 mg/100ml. This suggests the existence of a very large difference is 141.27 mg/100 ml so that it can be seen clearly that the use of this high enema very beneficial in lowering the blood urea levels in chronic renal failure patients could. In statistical comparison of levels of blood urea Post 3 days in the group treated with levels of blood urea Post 3 days in the control group in patients with Chronic Renal Failure in Space Rose Prof. Dr. Margono Soekardjo Hospital, after calculated by independent t - test values obtained  $t = -2859$  ( $p=0.008$ ). This suggests that there are differences in levels of blood urea Post 3 days in the group treated with levels of blood urea Post 3 days in the control group significantly. Urea levels in the blood is influenced by an increase in

intestinal fermentation, muscle metabolism and protein metabolism. The higher the level of intestinal fermentation, the higher the levels of urea levels in the blood. Under normal circumstances there is a bit of ammonia in the blood, the concentration ranges from 10 to 50 mg/100ml. Ammonia is removed rapidly from the blood and converted to urea in the liver. Most of the nitrogen in the blood flow in the form of amino acids. But this is very different in patients with chronic renal failure, ammonia levels can not be excluded to the maximum so that the levels of urea in the blood is increased.

## CONCLUSION

Blood urea levels in the treatment group before treatment is greater than in the control group. Urea levels in the blood after three days in the control group had increased levels of blood urea whereas after three days in the treatment group decreased. There is a significant difference between blood urea levels in the control group and the treatment group. Huknah effective to decrease high levels of urea in the blood in patients with chronic renal failure.

## References

- Budiman, C. (1995). *Pengantar statistik Kesehatan*. Jakarta : EGC.
- Brunner & Suddart, (2002) *Buku ajar Keperawatan Medical Bedah*. Jakarta. EGC
- Blake. (2001). *Gagal Ginjal Akut dan penatalaksanaanya*, Bandung Ilmu Penyakit Dalam FK UNPAD.
- Carpenito, L.J. (1995). *Nursing Care Plans and Documentation Nursing Diagnosis and Collaborative Problems*. Second edition. Philadelphia : Lippincott, Raven Publishers.
- Carrenter dan Lazarus (2001) *Gagal Ginjal Terminal dan perawatannya*. Jakarta
- Dorlan. 1994, *Kamus Kedokteran*, EGC, Jakarta
- Endeton, J.J. (1985). *Gagal Ginjal Kronik dan factor-faktor pemburuknya*, Bandung : Skripsi di bagian Ilmu Penyakit Dalam FK UNPAD.
- Goldshape (2006). *Prinsip perawatan pasien terminal*. Jakarta
- Harrison. (2000). *Prinsip-prinsip Ilmu Penyakit Dalam*. Vol 3 Jakarta EGC.
- Josep Vargas.( 1993) *Penyakit Saluran Kemih*. Edisi Revisi, Jakarta
- Kartono. (1992). *Penatalaksanaan Gagal Ginjal kronik*. Jakarta EGC
- Kresnawan dan Sukarjini (1992) *Penanganan Gagal Ginjal Akut dan Kronik*. Jakarta

Proceedings of International Conference  
On Education, Technology and Science 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Mansjoer, A. (1999). *Kapita Selekt Kedokteran*. Edisi 3. Jakarta : EGC
- Medicastore. (2006), *Info Penyakit Saluran Kemih*. Kumpulan gangguan sistem tubuh. Jakarta
- Nursalam (2001). Populasi dan sampel dalam penelitian, Jakarta
- Parsudi (1990). *Pengelolaan Gagal Ginjal Terminal* dalam Soewitho A dan Poewarwanto AP. Edisi. Semarang : Sipsosium gagal ginjal kronik/terminal
- Parsoedi (1994) faktor-faktor penyebab penyakit Kronik Jakarta
- Pearce. (1995). Penanganan Gagal Ginjal Kronik. Edisi. Semarang Gagal Ginjal Kronik
- Paterson (1995). *Gagal Ginjal Kronik*, Jakarta : Sub bagian ginjal Hipertensi bagian ilmu Penyakit Dalam, FKUI
- Prodjosudjadi, W. (2004). *Gagal Ginjal Kronik*, Jakarta : Sub bagian ginjal Hipertensi bagian ilmu Penyakit Dalam, FKUI
- P Juldema (1976)., Amoebiasis ; Bagian Penyakit Tropik Institut Woor de Tropen Amsterdam. *CDK* ;8-12
- Raharjo P, Endang, S & Suhardjono. (2001). *Dialisis dalam Tjokronegoro Arjatmo*. Jakarta : Utama Hendra Ilmu Penyakit Dalam, FKUI
- Rahardjo (1996) Transplatasi Ginjal, Jakarta
- Roesma (1992), Dialisis renal. Jakarta Hendra Ilmu Penyakit Dalam, FKUI
- Sidabutar, R.P. (1992) *Gizi pada GJK*. Beberapa Aspek Penatalaksanaan. Perkumpulan Nefrologi Indonesia Soekojo saleh, Kanker saluran cerna., *CDK* ;13-15
- Sutejo, 1976 Pengalaman dan saran mengenai Diare Akut pada bayi dan anak., *CDK*; 5-7 Jakarta.
- Suhardjono (2001) Hmodialisa dan Peritoneal Dialisa Jakarta
- Tszamaloukas. (1993) *Destroyed Kidney Fuction*. USA
- Venofer. (2006). *Iron Sucrose Injection, USP. Kidney Fuction*. America Regent
- Whorton J (2000) *Nutrision of kidney deases* USA.

**RELATIONSHIP BETWEEN HYPNOBIRTHING RELAXATION TECHNIQUES  
AND CHILDBIRTH DURATION OF STAGE 1 ON BPM SAYIDAH  
KEC. KALIWUNGU KAB.KENDAL**

**Maria Ulfah Kurnia Dewi**

**Abstract**

*Every time a woman think about childbirth that would be faced, there may appear a shade of stress, pain, and high risk so she entering childbirth process with anxiety and stress. Stress, anxiety, and fear can make heavier pain and will delay the childbirth process. The purpose of this study was to determine relationship between hypnobirthing relaxation technique and childbirth duration of stage 1 on BPM Sayidah Kec. Kaliwungu Kab. Kendal. The research method is analytic study with cross sectional approach. Objects were taken by purposive sampling with amount of sample 28 people. The data that obtained were tested using Point biserial. The results showed that there is a relationship between hypnobirthing relaxation technique and childbirth duration of stage 1 on BPM Sayidah Kec. Kaliwungu Kab. Kendal. Thus the conclusion, there is a relationship between hypnobirthing relaxation technique and childbirth duration of stage 1 on BPM Sayidah Kec. Kaliwungu Kab. Kendal.*

**Keywords:** *childbirth duration, hypnobirthing, stage 1*

**BACKGROUND**

Every mother expects childbirth process through smoothly without any obstacle. Many preparations were made from the beginning of pregnancy until near of baby birth process.

**A. Normal Chidbirth Process**

Normal Chidbirth Process is a normal childbirth that come out process of pregnancy product that includes baby, placenta and amniotic membranes, with cephalic presentation (position behind the head), from the mother's womb through the birth canal, with the mother's own power (no outside intervention).

**B. First stage of childbirth**

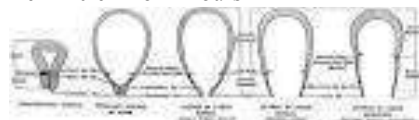
First stage of childbirth is also called by opening. That is the opening of cervix, signed by womb contractions causing the opening of the cervix so that it going to be complete. Starting from the opening of 1-10 cm. At the stage of the childbirth process, the first stage is

divided into two phases, named the latent phase and the active phase childbirth.

Latent phase in a process of delivering a baby which is very slow opening phase is the opening that starts from 0 to 3 cm which takes approximately 8 hours

The active phase in stage 1 childbirth is divided into three, namely :

1. Accelerated phase, from the opening of 3 cm to 4 cm are achieved within 2 hours
2. Maximum dilatation phase starting from the opening of 4 cm to 9 cm are achieved within 2 hours
3. Decelerasi phase starts from the opening 9 cm-10 cm for 2 hours



**C. Hypnobirthing**

Hypnobirthing method was developed based on the belief that the holistic childbirth preparation / holistic (Body, Mind and Spirit) then at the time of delivery, a woman and also a companion (husband), will be through the birth experience safe, comfortable, quiet and satisfying, much from the fear that causes tension and pain. In other words, if the mind and body achieve a state of harmony, then nature will be able to function in the same way as in nature and environment. Hypnobirthing method was also developed based on the belief that with enough preparation for childbirth, expectant mothers during labor and companion will be through the birth experience safe, quiet, comfortable and satisfying, much of the fear and anxiety that cause tension and pain. Hypnobirthing method was developed based on the belief that the holistic childbirth preparation/holistic (Body, Mind and Spirit) through the experience of giving birth can be a safe, comfortable, quiet and satisfying. Hypnobirthing process works by the power of suggestion. This process uses a positive affirmation, suggestion and visualization to calm the body, mind guiding and controlling her



breath. Pregnant women can do this alone (self-hypnosis) or with a midwife. By providing verbal affirmations help to tap into calm conditions. Also performed through visualization (imagine flowers are blooming, seeing rainbows, seeing what would happen to someone, etc.) or by using Idio motor to reach relaxation. Hypnobirthing relaxation exercises began in the seventh month of pregnancy. Hypnobirthing will lead mothers do not think about the pain caused by contraction. Hypnobirthing can make mothers stay relaxed and not panic so that smoothly through childbirth.

Affirmations that used in hypnobirthing :

1. I intend to relax for peace of mind
2. I felt calm and peaceful
3. My body, my muscles, and my mind rested
4. I breathe calmly and regularly according to my intention to relax
5. My emotions were stable
6. Nature and environment harmony in accordance with the my conditions
7. I live a pleasant pregnancy
8. Body and my baby is getting healthy
9. I give a positive aura to my baby
10. I can let go all of the tension that is in my body
11. Every breath that I breathe will healthy my baby
12. I happy welcome the baby
13. When I relax my baby relaxed too
14. Contraction feels comfortable for me

According to Jones (2001), every time a woman think about childbirth that would be faced, there may appear a shade of stress, pain, and risk so she entering childbirth process with anxiety and tension. Stress, anxiety, and fear can make heavier pain and will delay the childbirth process. Soedarjo et al (2008) said that the new technique involving hypnosis and meditation mother give hopes to mother to feel no pain during childbirth. Hypnobirthing method supports acceleration of childbirth process.

BPM Sayidah Kec. Kaliwungu Kab. Kendal provides childbirth services by using hypnobirthing relaxation techniques. The reason pregnant women who planned childbirth process with hypnobirthing relaxation technique is to reduce the pain during childbirth and through the childbirth process smoothly and fast.

## METHOD

Type of research is analytic study that tries to assess how and why the health phenomenon is

happens in order to see the relationship between one variable with another variable (Notoatmodjo, 2005). Approach in this study using cross-sectional which data collection is taken at the same time. This method aims to obtain complete data in short time relatively (Arikunto, 2002). Location of study was conducted on BPM Sayidah Kec. Kaliwungu Kab. Kendal with research time in November-December 2013. The population of this study are all women who had deliver baby in BPM Sayidah Kec. Kaliwungu Kab. Kendal. Sampling technique of this study is purposive sampling. Amount of sample is 28 people. Research instruments that used in this study are sheets of implementation of hypnobirthing relaxation technique and childbirth duration of stage 1. Data collection is taken from secondary data of implementation of hypnobirthing relaxation technique and childbirth duration of stage 1. The final step is data analysis to determine the relationship between hypnobirthing relaxation technique and childbirth duration of stage 1 with test Point biserial.

## RESULTS AND DISCUSSION

The results of statistical tests using Point biserial shows the p value 0,000 ( $\alpha=0,05$ ). This means that  $H_0$  is rejected, means that there is a relationship between hypnobirthing relaxation technique and childbirth duration of stage 1. Long duration childbirth process make mother stress and weak for longer so the pain will be increase. Long childbirth duration that caused by big baby or abnormalities in the pelvis resulting pain and weakness can delay childbirth process. Study conducted by Yuliatun et al (2008) notes that the respondents did not experience pain during childbirth process when hypnobirthing relaxation is done. Childbirth process through more quickly, postpartum recover early, and faster connecting bound between mother and her baby.

Hypnobirthing prenatal class has proven to answer the concerns and fears of pregnant women to face pain during childbirth, such as the data that found in research conducted by Gallagher, S in 2001 which states that the active phase in nulliparous women have 12 hours, while the women who followed Hypnobirthing prenatal class have active phase of 4.5 hours. While average time of stage 2 (delivering baby) in nulliparous is 2 hours whereas in women following a hypnobirthing prenatal class is 1 hour. In another study conducted by Am J.C.H (2004) shows women that attend hypnobirthing prenatal class has a more positive emotional and did not have any psychological problems in postpartum than women who did not attend prenatal classes

hypnobirthing. This method teaches that, in the absence of fear and tension, pain does not have always be in the delivery process. Learning of how the muscles work with each other in harmony or riley make the mother through childbirth fluently.

Based on the research conducted by Khayati, N (2011) with title The use of Telehypnobirthing prenatal class in hospital that has been done by using hypnobirthing, shows that the second stage is faster from 12 hours to 4.5 hours. Furthermore, hypnobirthing bring a positive influence in the client mental changes that experience pain in antenatal and intranatal. Referring to this results, hypnobirthing program would need to be developed to minimize the time and energy of the client and health workers in the form of therapy that is guided and monitored from long distance by telehypnobirthing.

Graves (2013) writes hypnobirthing is often regarded as a method of pain relief without drugs. This is to miss the point, as it presupposes that pain is there in the first place. When a woman learns to release the preconceptions, fears and worries about birth that are endemic in our society, her experience of giving birth to her baby can be the most wonderful and empowering experience of her life. Mind and body working together can be a powerful and efficient combination. This is how birth is designed to be, as midwives and hospitals are beginning to discover. Thus hypnobirthing can provide a service that women want as well as save funds.

## CONCLUSION

There is a relationship between hypnobirthing relaxation technique and childbirth duration of stage 1 on BPM Sayidah Kec. Kaliwungu Kab. Kendal.

## References

- Andriana, E. 2007. *Melahirkan tanpa rasa sakit dengan metode relaksasi hypnobirthing*. Bhuana Ilmu Populer. Jakarta.
- Arikunto, S. 2006. *Prosedur penelitian. Suatu pendekatan praktik*. Rineka Cipta. Jakarta.
- Bobak et al. 2000. *Buku ajar keperawatan maternitas*. Edisi 4. EGC. Jakarta.
- Graves, K. 2013. *A dream birth? Try hypnobirthing!* Journal The Practising Midwife.[Pract Midwife] 2013 Sep; Vol. 16 (8), pp. S13-4. Publisher: Hochland & Hochland . Accessed on 25 November 2013.
- JNPK-KR. 2007. *Asuhan persalinan normal*. JHPIEGO. Jakarta.
- Mochtar, R. 2007. *Sinopsis obstetri*. EGC. Jakarta.
- Mongan,MF. 2007. *Hypnobirthing. The Mongan Method*. Bhuana Ilmu Komputer Populer. Jakarta.
- Joseph dan Nugroho. 2010. *Catatan kuliah ginekologi dan obstetri (Obsgyn) untuk keperawatan dan kebidanan*. Nuha Medika. Yogyakarta.
- Khayati, N. 2011. *Penggunaan telehypnobirthing pada prenatal class di rumah sakit*. Jurnal Ilmu dan Teknologi Kesehatan Vol 2, No 1(2011). Publisher: STIKES Widya Husada Semarang. Accessed on 25 November 2013.
- Notoatmojo, S. 2005. *Metodologi penelitian kesehatan*. Rineka Cipta. Jakarta.
- Setiadi. 2007. *Konsep dan penulisan riset keperawatan*. Cetakan pertama. Graha Ilmu. Yogyakarta.
- Sugiyono. 2007. *Statistika untuk penelitian*. Alfabeta. Bandung.
- Sugiyono. 2010. *Metode penelitian kuantitatif kualitatif dan R&D*. Alfa Beta. Bandung.
- Varney, H. 2001. *Buku ajar asuhan kebidanan*. EGC. Jakarta.
- Wiknjosastro, H. 2005. *Ilmu kebidanan*. YBPSP. Jakarta.
- Yuliatun, L. 2008. *Penanganan nyeri persalinan dengan metode nonfarmakologi*. Banyumedia publishing. Malang.

## TELEHEALTH IMPLEMENTATION USING AN ONLINE MEETING APPLICATION FOR THE REMOTE AREA HEALTH SERVICES

Muchlas\* and Rizky Nur Ardia Oktaviani\*\*

\*Department of Electrical Engineering, Universitas Ahmad Dahlan

\*\*Department of Public Health, Universitas Ahmad Dahlan

Corresponding author: muchlas.te@uad.ac.id (Muchlas)

### Abstract

*The increase of population growth in Indonesia is followed by greater demand of health professionals, especially medical doctors. Currently, ratio between number of doctors and patients in Indonesia is still below the normal line that leads to less health care. On the other hand, health care introduces cost aspect moreover for the patients living in remote areas experiencing the problem by the distance to the health services. This study proposes the technique to overcome these constraints through the implementation of telehealth using an online meeting application of Team Viewer.*

*The subjects used for the research study are doctors, nurses and patients in a clinician to patient consultations scenario, using video teleconferencing support based on the online meeting application of Team Viewer. To justify the success of the tested model, this research has collected the perception data of the subject at ease aspects of the consultation process. From the work done, the results show that the telehealth model using an online meeting application is easily implemented and give a positive perception of the doctor and the patient.*

### INTRODUCTION

According to the Central Bureau of Statistics (2010), current population of Indonesia has reached 237.556.363 people. It is estimated that number will increase up to 273.65 million people by 2025. Inline with increasing number of people, the life expectancy of population is also increased up to 73.7 years in 2025. Both numbers show an implication to the increasing of health care needs especially hospitals and health professionals, both doctors and paramedics, as well.

Currently, the needs of health professionals especially doctors in Indonesia are still not ideal, particularly in remote areas. This lack is indicated by the low ratio between the number of doctors to the patients of 3 doctors for 10,000 peoples (1:3.300) refers to the ideal ratio of 1:2.500.

On the other hand, the government has been introducing a regulation to improve health services such as the enactment of the National Social Security System on January 1, 2014, unfortunately that effort is still not sufficient with availability of doctors. As a result, health services conducted by various health institutions around Indonesia is not optimum. For the case in remote areas, health care problems will be more serious due to the insufficient number of health professionals especially doctors only in urban areas.

To overcome this problem, some countries have implemented and evaluated the concept of telehealth on their health care systems, such in the UK through the Whole System Demonstrator Action Network project (Giordano, 2011), in the United States backed the legislation Telehealth Promotion Act (Boucher, 2013), and in Australia through projects under the coordination of the National E-Health Transition Authority (Doha, 2012).

Boucher (2013), defines telehealth as the use of medical information exchange system from one place to another via electronic communications to improve patients' health service. In implementation, telehealth appears in the following four forms as mentioned by Puskin (2006) and Boucher (2013): (1) patient care, (2) medical education and mentoring, (3) consumer medical and health information, and (4) remote patient monitoring. In practice, telehealth aims to (1) change the behavior of patients to keep consulting of health care when getting ill; (2) improve the patient satisfaction due to lower operating costs, and (3) lowering the cost of acute care.

By considering the insufficient number of doctors, in a geographical aspect that population is dispersed from the urban to the remote areas, this situation leads the economic condition of the average community is not strong. Therefore, the concept of telehealth can be used as one of the right choices to improve health services in Indonesia.

According to Boucher (2013), telehealth is similar to the distance learning in higher education which requires the information technology support

such as video teleconferencing in its implementation. Currently, many applications of technology information was developed that can be used to support the implementation of video teleconferencing.

One application that is relatively easy to obtain and inexpensive is an online meeting application by the Team Viewer Corporation. This is because the company provides a free license version that can be downloaded from the provided website. This application also provides completed features that can be used to support the data exchange from text and images to a video format. In addition, this application has proven to be effective and easy to operate as tools for implementing online learning model for digital engineering practicum in college (Muchlas, 2012). This study has developed the models of patient care using telehealth based on online meeting application of Team Viewer.

## METHOD

The model used in this study is the clinician to patient consultation of Trusson (2012) as shown in Figure 1 below.

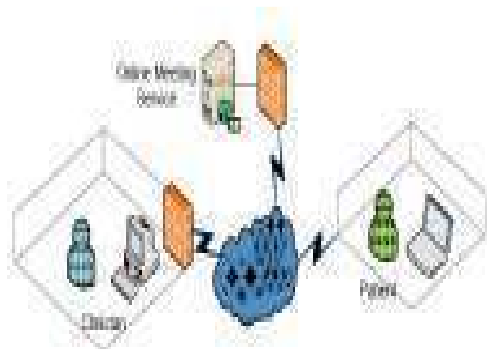


Figure 1. Model of *Clinician to Patient Consultation*

On the patient side, the system is run by an operator. During the consultation, the patient is accompanied by a nurse that previously sending the first supporting data of the patient such as blood pressure, height, weight and body temperature. Meanwhile in the doctor's side, the system is operated directly by the physician such as host in online activity.

To run this system, the developed telehealth in this research requires PC or laptop supported by peripherals that support the video conference facilities. Meanwhile in the software aspect, this system requires an online meeting application of Team Viewer and its user interface as shown in

Figure 2. Meanwhile online meeting panels is shown in Figure 3.



Figure 2. The interface of online meeting application from Team Viewer

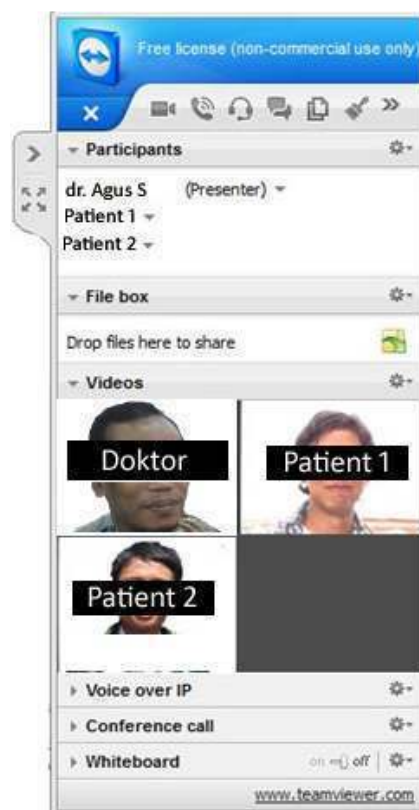


Figure 3. The Panels of online meeting application from Team Viewer

In this study, the success of the developed telehealth models is indicated by the result of subjects perceptions test of physician. To find out

the doctor's perceptions, this research has been conducted a live interview.

## RESULT AND DISCUSSION

The research done has produced a telehealth system for the purpose of patients consultation based on an online meeting application software. The developed system uses the clinician to patient consultation model that follows the stages as follow.

### Stage 1

In this scenario, the doctor become a host in online meeting activity. Through the interface of online meeting application, the doctor will get an meeting ID.

### Stage 2

Doctor doing abroadcasting the meeting ID to all nodes of patients via email or message based on mobile communications devices.

### Stage 3

Operators around the patient nodes receiving the meeting ID sent by the doctor. Furthermore, the operator doing a join meeting using the meeting ID received from the doctor.

### Stage 4

After doctors and operators in patient nodes have joined in an online meeting forum, both doing to set the video share in ON mode.

### Stage 5

In a patient node, nurses conduct a preliminary physical treatment of the patient who will consult to the physician by collecting data such as blood pressure, height, weight and body temperature. Furthermore, through the operator, the nurse sends the data using a File Box facility to the doctor. Before the consultation, the doctor has to download first a file of preliminary physical data that already sent by a nurse, also via File Box facility.

### Stage 6

Physician doing the dialog consultation to the patient via video teleconferencing assisted by nurse in the node patient location.

### Stage 7

Doctor writing the medical recommendation using Word application and send it to the patient via the File Box facility in online meeting application.

### Stage 8

Nurse that is assisted by an operator at patient node will download the recommendation file sent by the doctor, then printing it into a paper to be delivered to the patient.

The result of test shows that in general, the system has worked well, although produces some technical problems. From the aspect of video transmission (video streaming), delays are found for the system transmission in some segments. This is due to the low capacity of available bandwidth to support video conferencing activities. To overcome these problems, the system has been equipped with voice over internet protocol (VoIP) that can be used to change the pattern of video communication to voice communication. In fact, if the transmission of video and sound are not working, the system will provide text conferencing through chat facility. Thus, the telehealth system has provided variety of digital communication hierarchy of video conferencing, audio conferencing to text conferencing that all of these are running on a synchronously mode.

From the aspects of health consultation mechanism, doctor has given a perception in which the system is less suitable for physical, especially for patients who suffering acute diseases and illnesses that require the intensive of physical. In this case, the physical handling of the patient should be done directly. This is because to determine the type of disease suffered by the patient, the doctor has to do physical handling to get the diagnosis data accurate.

In addition to the perceptions of consultation mechanisms, physicians also provide their perceptions of the usefulness of these systems to support collaborative work among the doctors. The doctor has given perception that the system can be used to support online discussion from various hospitals.

## CONCLUSION

The research study has shown that telehealth can be implemented easily using the online meeting application from Team Viewer. The proposed telehealth system run based on that technology is a type of medical consultations between doctor and patient. In physician perception, the developed telehealth system can run well and useful as a media for consultation between doctor and patient and also can be used to support the programs to improve health services in remote areas.

The telehealth system developed provides three different communication hierarchy *i.e.* video

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

teleconferencing, teleconferencing audio, and text conferencing.

**References**

Boucher, B. 2013. *Trends in Telehealth*. USA: NTT Data, Inc.

DoHA (Department of Health and Ageing). 2012. *Telehealth Technical Standards Position Paper*. Canberra: Commonwealth of Australia.

Giordano, R., Clark, M. & Goodwin, N. 2011. *Perspectives on telehealth and telecare*. London: WSD Action Network.

Muchlas. 2012. *Online Teaching Model Based on Multimedia Technology for Digital Engineering Practical Work*, Proceeding International Conference on Culture, Communication and Multimedia Technology, Ahmad Dahlan University, Yogyakarta, 1 December 2012.

Puskin, D., Johnston, B., &Speedie, S. 2006. *Telemedicine, Telehealth, and HealthInformation Technology*. Washington: The American Telemedicine Association.

Trusson, R. 2012. *Online Meeting Services: Information Governance Guidance*.UK: Crown.

## DEVELOPMENT OF SURV-TB (TUBERCULOSIS SURVEILLANCE WEBGIS)

Noor Alis Setiyadi<sup>1</sup>, Sabarinah B. Prasetyo<sup>2</sup>

<sup>1</sup>Prodi Kesehatan Masyarakat, Fakultas Ilmu Kesehatan, Universitas Muhammadiyah Surakarta. Jl Ahmad Yani Tromol Pos I Pabelan Kartasura Sukoharjo Surakarta. Telp 0271-717417, Email : nuralis2009@ums.ac.id.

<sup>2</sup>Fakultas Kesehatan Masyarakat, Universitas Indonesia

### Abstract

*Since 800SM, tuberculosis disease has been found, but it is still be a problem in the world, thus the United Nations (UN) decided tuberculosis eradication is part of Millennium Development Goals (MDGs). Strategy of Directly Observed Treatment Short-course (DOTS) have been made to achieve program indicators successfully, the indicators were such as suspects catching and cases discovery (Case Detection Rate/CDR). The development of Tuberculosis Surveillance WebGIS (TB-Surv) can support the DOTS.*

*This research used qualitative research methods approach and the study design used a combined approach between SDLC-prototype, where it is consists of existing systems evaluation, defining a new system requirements, designing the system based on the needs of end user identification and the development/prototype development. The research used the secondary and primary data via the interviews and confirmation. The system is tested to recording and reporting officer at the health department to get input for the perfection of the system.*

*The development of databases, software, data management menu interface, the web-based services access and geographic information systems has been performed by free software for the public accessibility. The TB-Surv will useful to speed up the recording and reporting of tuberculosis diseases, furthermore the spatial analysis image is expected to be an alternative information to make the decision. In addition, TB-Surv systems have facilities to summarize reports plus displaying a suspects catching and CDR indicators by graphic.*

**Keywords:** Surv-TB, tuberculosis surveillans, webgis

### BACKGROUND

Tuberculosis disease has been known since 8000SM, but the number of cases of pulmonary tuberculosis increased and many of them have not been cured, so the World Health Organization

(WHO) in 1993 determined a tuberculosis as a global emergency (Depkes, 2008). United Nations (UN) determine 8 (eight) Millennium Development Goals (MDGs) in 2015, one of them is combating the spread of HIV/AIDS and other diseases, including Tuberculosis disease (Bappenas, 2010).

DOTS strategy has a primary focus of the discovery and cure of patients with the type of infections priority of tuberculosis patients. Finding and healing effort of patient is the best way in efforts to prevent the tuberculosis (Depkes, 2008). Case-finding activities consist of netting suspected, diagnosis, determination of classification and types of disease. The discovery of new patients with positive BTA of tuberculosis subsequently used as indicators to assess the progress and success of national tuberculosis countermeasures (Depkes, 2008). Indicators of a successful response to tuberculosis countermeasures, among other suspected crawl rate and case detection rate (Case Detection Rate/CDR) (Depkes, 2008).

Health Ministry of Indonesia determined a magnitude indicator of national CDR which was 70%. The report of Indonesia health profile in 2009 tells that the lowest achievement of CDR is the Central Kalimantan province (30.6%) and the highest in the of North Sulawesi Province (85.2%), Whereas the other regions around them including the Central Java with CDR achievement in 2009 was 48%.

Health profile mentions states that the achievement of Case Detection Rate (CDR) in Central Java from the year 2005-2009 as follows: 2005 (50.92%), 2006 (49.82%), 2007 (47.45%), 2008 (47.97%), and 2009 (48.1%). The data showed that the Central Java Province was still remains a part of the priority to eradicate the disease.

Surveillance activities is short term (observation and prediction) and long activities (evaluation). In making observations can be linked in the management of tuberculosis in which area-based management should pay attention at 2 activities, of risk factors management, both of them which must be done simultaneously and backed by

good surveillance. In addition, the DOTS approach emphasizes the importance of case management approach by combining the control of risk factors (Achmadi, 2008). Strengthening health systems is one of six strategies to stop tuberculosis, mentioning therein that the weakness of the information (including monitoring and evaluation), among others, the weak and the quality of vital statistics and geographic information systems for disease surveillance. For that reason, it is required the recording and reporting system connected with national health system that can be used to analyze the problem and be able improving the performance in region (WHO, 2009).

Sukoharjo Region Health Department has developed a Community Health Center Information System which is implemented in all health centers and at this year's planned system will be developed based on the web. Sugiasi (Undip, 2005) who developed tuberculosis surveillance information system to support the evaluation of results of activities in the Department of Health P2TB Sukoharjo. However, the system can not be used by section officers P2P and tuberculosis programs due to lack of data input is complete, the application can not renew the tuberculosis patient data and the lack of software manuals are easily understood by the officers.

Based on explanation above, researcher interested to develop the surv-tb (tuberculosis surveillans webgis) in tuberculosis program health policy. The scope of the study was limited in the Work Area Health Service Sukoharjo and implementation of the system development process is implemented to the extent tested for tuberculosis at the Public Health Service officer Sukoharjo.

## METHODE

The research method used qualitative approach where the collecting data was done by interviewing the samples selected. In addition, the system development used was prototyping method system development (Marimin, 2010).

The data collected was based on secondary and primary source. The secondary data was derived from the recording and reporting the results reported in the Public Health Service of tuberculosis in Sukoharjo years 2005-2010. The primary data was obtained from interviewing to the person who are involved directly in the tuberculosis surveillance system, observation of system support and implementation of activities, review of documents related to organizational policies, standard operating activities procedures, program planning of surveillance tuberculosis and

documentation system, to confirm to the officer at the health department of tuberculosis after testing the system to obtain information for repairing the information system.

The respondents was selected by purposive sample method where the sources of information were obtained from people who engaging in tuberculosis surveillance activities with those arguments related with research topics, such as head of health department in district, section heads disease control, section chief of information and health data, and tuberculosis officers. The instrument consists of interviews with Topic guidelines: identifying the need for Information Systems tuberculosis surveillance and testing of the possibility of applying the system, problems in the system, using of computers, systems of development opportunities and the desired system output, the recorder will be used to record the interview process, and documentation recording and reporting of health centers and health department regarding the completeness of data.

The method used in the development of this system was prototyping approach, namely evaluating the existing system, make definition system requirements that is new, designing systems based on identification of user needs and system developing.

Stages of defining new system requirements specify the deficiencies that exist in the system that will be constructed to be a concern for the improvement of the system built. Stages of designing a system was based on the identification of user requirements (end user) by four stages, namely firstly, Making flow chart with the method used is HIPO (Hierarchy Plus Input-Process-Output) by using the overview diagram (recapitulations diagram), making the context diagram, Data Flow Diagrams (DFD), and constructing Relationship Entity Diagram (ERD). Secondly, the constructing of base stages in data types collection, data normalization, entity relationship creation (ERD) between tables.

Thirdly, creating of a design system based on the results of the identification of the needs of system users, including interface and manual user.

Lastly, constructing or developing the prototype of surv-tb where the data would be recorded and reported with localhost AppServer in which there are already software to design Mysql database, after the design of the database is complete and then create a menu entry with php software. Java software is also used in carrying out the planned application.



## RESULTS AND DISCUSSION

### A. Results

The prototype was developed with the approach of geographic information systems and web-based. Users can use the web browser of Mozilla Firefox or Internet explorer. This Development is done in the offline server (AppServ) by <http://localhost/surv-tb/> address. After the user entered the address into a web browser, the user will enter the login interface where as tb officer will be required to enter his username and password while users are not guests. Tuberculosis Officers can manage the data while common user can only see the view that has been determined.

#### a. The design of the interface



Picture 1  
Main login of surv-tb

#### b. The main view website



Picture 2  
The main display applications Surveillance Information System

The main display pages consisting of eight items that include spatial and non spatial representation that are: 1. Header and title application, 2. The main menu which consists of

data management, change display, guider book, on application, user settings, password settings and logout, 3. Navigation menu map that consists of zoom-in, zoom out, panning, distance, info and reset panels, 4. Layer control tabs, legends and tracking data, 5. Layer control, 6. Space map, 7. Inset map, 8. Instruction of pointer position coordinates on the panel where it can be shown the location of x and y which are coordinates of a point in the region.

### B. Discussion

Geographic information system application in monitoring the nutritional status of children claimed processing and storage of data on systems that do not use a database can complicate the process of changing data structures (Mutalazimah, 2009). In addition, Support geographic information systems that exist in the system helps the presentation and interpretation of data (Mutalazimah, 2009). According to Guidelines Disease Surveillance Epidemiology Epidemiological Surveillance Information that the results for early vigilance Extraordinary Events should complete the epidemiological variables include the place, which can be shown by mapping the patient according to a specific area, such as urban villages. This mapping will help the Health Department conduct monitoring activities of the Local Area (PWS) (Masrochah, 2006).

Menu entries are made for easier of facilitate the officers in entering data and are able to perform updates data. Development of an input form using php programming language because it is expected to be easier to integrate with SIMPUS web-based health department that will be developed. Other inputs included in the data base is the point where the clinic (see the appendix) and Sukoharjo regency map. Compared with previously developed systems, the advantages of this system on the development tools used, the completeness of the input variables, the point of the case, updating facilities, data bases and output analysis.

The design output is being developed aims to facilitate the desired outcome picture, get a recapitulation of routine data recording and reporting forms are still limited to the registers. Speed in making the recapitulation result of surveillance/monitoring is one indicator of the performance of computer-based systems compared with conventional systems in support of management functions (Mutalazimah, 2009). Other outputs which can be carried out this application is capable of monitoring the distribution picture of tuberculosis cases in the Sukoharjo.

## CONCLUSIONS

This surveillance information system is capable of supporting the monitoring of tuberculosis disease that can be used as additional references and plan health programs in Sukoharjo region. Surveillance information system is capable of accelerating the recording and reporting of tuberculosis disease during the perceived by the official is slow because the system allows online data input by each clinic or the health center. Surveillance information system generates output analysis of tuberculosis disease in non-spatial and spatial indicators. The excess of tuberculosis surveillance information system development compared to the previous information system is expected to be applied in the Public Health Service of Sukoharjo.

The development of this prototype can be applied in the health department with the development of not only limited monitoring of tuberculosis but also the success of the program through other indicators. Establishment of networks with the health service in the development of tuberculosis surveillance information systems through research, training and public service.

## References

- Achmadi, U. F. (2008). *Manajemen Penyakit Berbasis Wilayah*. Jakarta: Universitas Indonesia.
- Bappenas. (2010). *Laporan Pencapaian Tujuan Pembangunan Milenium di Indonesia*. Jakarta.
- Depkes. (2008). *Pedoman Nasional Penanggulangan Tuberkulosis*. (D. RI, Ed.) (Edisi 2.). Jakarta: Departemen Kesehatan RI.
- Marimin, D. (2010). *Sistem Informasi Manajemen Sumber Daya Manusia*. Jakarta: Grasindo.
- Masrochah, S. (2006). *Sistem Informasi Surveilans Epidemiologi sebagai Pendukung Kewaspadaan Dini Kejadian Luar Biasa (KLB) Penyakit di Dinas Kesehatan Kota Semarang*. Universitas Diponegoro.
- Mutalazimah, D. (2009). Aplikasi Sistem Informasi Geografis pada Pemantauan Status Gizi Balita di Dinas Kesehatan Kabupaten Sukoharjo. *Forum Geografi*, 23(2), 153–166.
- WHO. (2009). *Global Tuberculosis Control, Surveillance, Planning, Financing*. Geneva.

## STUDY OF POST-STROKE HYPERGLYCEMIA THERAPY ON STROKE INPATIENTS IN PKU MUHAMMADIYAH YOGYAKARTA HOSPITAL

Nurul Maziyyah<sup>1)</sup> Sugiyanto<sup>2)</sup> Inayati<sup>3)</sup>

<sup>1)</sup>Pharmacy Programme, UMY, <sup>2)</sup>Faculty of Pharmacy, UGM, <sup>3)</sup>PKU Muhammadiyah  
Yogyakarta Hospital

### Abstract

*Poststroke Hyperglycemia (PSH) occurs commonly in clinical settings. About 40% of patient with acute ischemic stroke is found with hyperglycemia. PSH is associated with poorer outcome in diabetic and non-diabetic patients. Recommendation for PSH therapy is insulin-based therapy. Unfortunately, until now the optimum method of insulin therapy for PSH has not yet been agreed. The objective of this study is to determine the prevalence of PSH, give a description on the therapy used for PSH and analyze the given therapy in PKU Muhammadiyah Yogyakarta Hospital.*

*This study used a non-experimental design by using a descriptive-analytic method. Data was gained retrospectively by reading medical records of stroke inpatients in the period of October 2011 – October 2012. The prevalence of PSH was determined from all samples observed. Evaluation of hyperglycemia therapy given to PSH patients was carried out based on guidelines available given into consideration whether the patient had Diabetes Mellitus (DM) or not.*

*The result of the study shows that the prevalence of PSH was 46% among stroke patients (non hemorrhagic and hemorrhagic). Therapy of PSH in the hospital still used oral antidiabetics, single or in combination (23,58%) which was not in line with guidelines available, while 16,03% of patients were given insulin therapy. There were 65 cases (61,32%) of PSH patients who were not given any therapy for the hyperglycemia event, whereas most of them (96,92%) were non-diabetic patients.*

**Keywords:** Poststroke hyperglycemia (PSH), Diabetes Mellitus

### BACKGROUND

Poststroke Hyperglycemia (PSH) occurs commonly in clinical settings. About 40% of patient with acute ischemic stroke is found with hyperglycemia (>130 mg/dL) (Gentile et al, 2006). PSH is associated with poorer outcome in diabetic and non-diabetic patients. Until now the optimum method of insulin therapy for PSH has not yet given a consensus. Several guidelines available

recommends decreasing of blood glucose concentration, but there hasn't been any agreement on the limit to therapy, insulin regiment used, and the target of therapy (McCormick et al, 2008). From this background, it is needed to evaluate PSH therapy in Yogyakarta where stroke incidence is relatively high. This can be shown from data gained from PKU Muhammadiyah Yogyakarta Hospital where stroke cases is ranked in the top ten cases in 2010 and 2011.

### OBJECTIVE

1. To describe the prevalence of PSH in acute stroke inpatients in PKU Muhammadiyah Yogyakarta.
2. To describe and evaluate the therapy of PSH in acute stroke inpatients in PKU Muhammadiyah Yogyakarta compared with guidelines available.

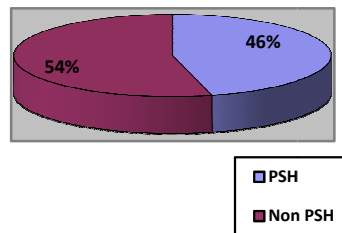
### RESEARCH METHOD

This study used a non-experimental design by using a descriptive-analytic method. Data is gained retrospectively by reading medical records of stroke inpatients in the period of October 2011 – October 2012. Data of stroke patients with PSH was then analyzed and evaluated by dividing them into groups of patients with a history of Diabetes Mellitus (DM) and non-DM. The study consist of evaluating the therapy given compared with guidelines used by the researcher which are from American Stroke Association (2007), European Stroke Organization (2008), and PERDOSSI (2007).

### RESULT AND DISCUSSION

#### 1. Prevalence of Poststroke Hyperglycemia

From the data gained, it is shown that the prevalence of poststroke hyperglycemia was 46% from all stroke inpatients in the period of October 2011-October 2012. PSH event was defined as blood glucose level > 140 mg/dL in the time they entered hospital. This result is not different from previous studies which mentions that the occurrence of PSH is around 40 to 50% (Gentile et al, 2006) (Zacharia et al, 2005).



Picture 1. PSH Occurrence

Hyperglycemia in stroke patients based on this study does not only occur in patients with a history of DM. The result is 72 cases (68,22%) of PSH occurred in non-DM patients versus only 34 cases (31,78%) in diabetic patients. This suggests that the occurrence of PSH is not related with the history of DM in patients but more as a “stress hyperglycemia” which is defined as an increase in blood glucose level because of “stress hormones” release (catecholamines and cortisol) in response to stress conditions, such as stroke (Capes et al., 2001) (Quinn & Less, 2009).

Table 1. Blood Glucose Level of PSH Patients

Blood Glucose Level (mg/dL)	Number of Case /Percentage (%)				Total
	DM		Non DM		
140 - 180	5	14,71	45	62,50	50
181 - 210	2	5,88	12	16,67	14
211 - 300	15	44,12	10	13,89	25
>300	12	35,29	5	6,94	17
Total	34	100,00	72	100,00	106

Table 1 gives a description of blood glucose profile in PSH patients which we divided into diabetic patients and non-diabetic patients. The difference in blood glucose profile can be seen in table 1 where most diabetic patients (79,41%) were observed with a blood glucose above 210 mg/dL while non-diabetic patients were mostly (62,50%) observed with mild hyperglycemia (140 – 180 mg/dL).

Patients with DM has already have a disorder in controlling blood glucose before the onset of stroke, therefore, an acute stroke condition can lead to an increase in previously high blood glucose level. This condition is different in non diabetic patients where normal glucose level was present before the stroke. The above argument might be the cause of different blood glucose profile seen in PSH patients in this study.

## 2. Therapy of Poststroke Hyperglycemia

### a. Pattern of Therapy

Therapy given to PSH patients in PKU Muhammadiyah Yogyakarta Hospital consists of insulin therapy (15,09%) and oral antidiabetic therapy single or in combination (23,58%). Whereas 61,32% of PSH patients is not given any therapy for treating hyperglycemia, most of which are non-diabetic patients. This pattern is probably done assuming that glucose blood concentration would fall back after the acute phase. This action has a significant risk because the negative impact of persistent high blood glucose after stroke is quite high. Several reports has shown that mild hyperglycemia ( $\geq 126$  mg/dL and  $\leq 180$  mg/dL) is associated with poor prognosis in non-diabetic patients with acute ischemic stroke (Staszewski et al, 2011).

Tabel 2. Therapy Agent Used in PSH Patients

Therapy \ DM history	DM		Non DM	
	$\Sigma$	%	$\Sigma$	%
Single OAD	13	38,24	5	6,94
Double OAD	6	17,65	0	0,00
Insulin	12	35,29	4	5,56
OAD + Insulin	1	2,94	0	0,00
No therapy	2	5,88	63	87,50
<b>Total</b>	<b>34</b>	<b>100,00</b>	<b>72</b>	<b>100,00</b>

### b. Insulin Therapy

Insulin therapy was usually given to patients with blood glucose level  $> 300$  mg/dL. This is not in line with recommendation from guidelines which has set a therapy limit of blood glucose  $> 140$  mg/dL (ASA),  $> 180$  mg/dL (ESO), and  $> 150$  mg/dL (PERDOSSI). The result from insulin therapy was relatively good in diabetic patients where only 5 patients (from 12 patients) are left with blood glucose level above 150 mg/dL after  $\pm 24$  hours of therapy. The opposite result was seen in non-diabetic patients where 75% (3 from 4 patients) are still in the level above 150 mg/dL (Table 4). The various results from insulin therapy should be a concern in order to begin an intensive monitoring of blood glucose level, especially in non-diabetic patients to be given the right dosage of insulin.

### c. Oral Antidiabetic Therapy

Oral antidiabetics is most used in diabetic patients (80%). This is probably used as a continuation therapy of previous DM. Blood glucose level after oral antidiabetic therapy

shows that most of them still had a blood glucose level of  $> 150$  mg/dL after therapy (88%) (Table 5). Therefore it must be given into consideration whether PSH patients will be given oral antidiabetics instead of insulin therapy. Insulin based therapy is recommended for PSH event because of its rapid onset that is able to decrease blood glucose level significantly in a short time. This is important because persistent high blood glucose level can contribute to a poorer stroke outcome (Bruno et al, 2010).

Tabel 3. Use of Oral Antidiabetics

OAD Therapy	No of case		Total
	DM	Non DM	
Metformin	3	0	3
Glimepiride	9	5	14
Glibenklamide	1	0	1
Metformin + Glimepiride	5	0	5
Metformin + Glibenklamid	1	0	1
Glimepiride + Insulin	1	0	1
Total	20	5	25

Tabel 4. Comparison of Blood Glucose Level (BGL) *Pre* and *Post* Insulin Therapy

No	BGL (mg/dL)	Number of case				Total (Percentage)			
		DM		Non DM		Pre		Post	
		Pre	Post	Pre	Post				
1	$< 100$		2		0		2	12,50%	
2	100 - 150	0	5	0	0	0	0%	5	31,25%
3	151 - 200	2	2	0	1	2	12,50%	3	18,75%
4	$>200$	10	3	4	2	14	87,50%	5	31,25%
5	no data				1			1	6,25%
	Total	12	12	4	4	16	100,00%	16	100,00%

Tabel 5. Comparison of Blood Glucose Level (BGL) *Pre* and *Post* Oral Antidiabetics

No	BGL (mg/dL)	Number of case				Total (Percentage)			
		DM		Non DM		Pre		Post	
		Pre	Post	Pre	Post				
1	$< 100$		0		0		0	0,00	
2	100 - 150	1	2	0	0	1	4,00	2	8,00
3	151 - 200	2	7	0	3	2	8,00	10	40,00
4	$>200$	17	10	5	2	22	88,00	12	48,00
5	no data		1					1	4,00
	Total	20	20	5	5	25	100,00	25	100,00

## CONCLUSION

1. The prevalence of PSH was 46% among acute stroke inpatients in PKU Muhammadiyah Yogyakarta Hospital.
2. PSH therapy given in PKU Muhammadiyah Yogyakarta Hospital consisted of oral antidiabetics, single or in combination (23,58%) and insulin therapy (16,03%). There were 61,32% of PSH patients untreated for hyperglycemia whereas 96,92% of them were non-diabetic patients.

## References

1. Adams, H.P., del Zoppa, J.G., Alberts, M.J., Bhatt, D.L., Brasslet, L., Furlan, A. *et al* 2007, Guidelines for the Early Management of Adults With Ischemic Stroke, *Stroke*, **38**: 1655–1711.
2. Bruno, A., Liebeskind, D., Hao, Q., Raychev, R., 2010, Diabetes Mellitus, Acute Hyperglycemia, and Ischemic Stroke, *Current Treatment Options in Neurology*, **12**:492–503.
3. Capes, S.E., Hunt, D., Malmberg, K., Pathak, P., Gerstein, H.C., 2001, Stress Hyperglycemia and Prognosis of Stroke in Nondiabetic and Diabetic Patients: A Systematic Overview, *Stroke*, **32**: 2426 – 2432.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

4. Gentile, N.T., Seftchick, M.W., Huynh, T., Kruus, L.K., Gaughan, J., 2006, Decreased Mortality by Normalizing Blood Glucose after Acute Ischemic Stroke, *Academic Emergency Medicine*, **13**:174–180.
5. McCormick, M.T., Muir, K.W., Gray, C.S. and Walters, M.R., 2008, Management of Hyperglycemia in Acute Stroke : How, When, and for Whom?, *Stroke*. **39**:2177-2185.
6. Quinn, T.J. and Lees, K.R., 2009, Hyperglycemia in Acute Stroke – To Treat or Not To Treat, *Cerebrovasc Dis*, **27 (suppl 1)**: 148 – 155.
7. Staszewski, J., Brodacki, B., Kotowicz, J., and Stepień, A., 2011, Intravenous Insulin Therapy in The Maintenance of Strict Glycemic Control in Nondiabetic Acute Stroke Patients With Mild Hyperglycemia, *Journal of Stroke and Cerebrovascular Diseases*, **Vol. 20 No. 2**: 150 – 154.
8. The European Stroke Organisation (ESO) Executive Committee and ESO Writing Committee, 2008, Guidelines for the Management of Ischaemic Stroke and Transient Ischaemic Attack, *Cerebrovasc Dis*, **25**: 457–507.
9. Zacharia, T.S., Misbach, Y., dan Surjamihardja, A., 2005. Hiperglikemia Reaktif pada Stroke Fase Akut, *Berkala Ilmiah Kesehatan FATMAWATI*, **Vol 6 No.15**

## WEI CHI 14 MERIDIANS EXERCISE AND PATIENT AFFIRMACY AS THE EMOTIONAL THERAPY

Sutarno\*, Widyoningsih\*\*

\*Sutarno: Graduate Nursing, Health Science School Al-Irsyad Al-Islamiyyah Cilacap  
No. 24 Cerme Street Cilacap  
E-mail:myacunsutarno@gmail.com

### Abstract

**Background:** Emotional stress is one factor which causes the increasing blood pressure that needs to be controlled. Controlling emotion requires self-efficacy. Wei Chi 14 meridians exercise and patient affirmacy of self efficacy have the potential power to increase self efficacy emotional control.

**Method:** The objective of the study is to analyze the effect of Wei Chi 14 meridians exercise and patient affirmacy toward self efficacy emotional control. The design used a quasi-experimental: pretest-posttest without control group. The data was obtained from 41 patients with hypertension by using a questionnaire.

**Finding:** The average of pretest score is 79.61 and posttest score is 91.41. Wilcoxon sign rank test shows  $p$  value 0.000 at  $\alpha = 0.05$ . This study found that the combination of Wei Chi 14 Meridians exercise and patient affirmacy is significantly able to improve self efficacy emotional control.

**Conclusion:** Wei Chi 14 Meridians exercise and patient affirmacy improve self efficacy emotional control effectively.

**Keywords:** Hypertension, exercise, meridian, affirmation

### INTRODUCTION

Hypertension is a serious disease which attacked human health as its known as "The Silent Killer". It causes some serious diseases such as stroke, heart failure, heart attack and kidney damage (Muhammadun, 2010). The number of hypertension has increased by the year. Susilo and Wulandari (2011) reveals that hypertension is a health problem which is suffered by almost all classes and the suffering number of the people has increased by the year. WHO estimates the suffering number of hypertension increases highly to the year 2025 which will achieve around 29.2% (Apriany, Afrida RE & Tati, 2012).

Blood pressure in hypertensive patients often go up and down. One medium which can lead to increase blood pressure is negative emotion.

Samuel J. (2012) states that the ongoing negative emotion causes continually an increasing blood pressure.

Emotional control can be done in various ways. One potential way to control emotion is Wei Chi 14 Meridians exercise. Sutarno 2013 states that Wei Chi exercise is an exercise in soft and beatiful rhythm movement past through the meridian line. Wei Chi 14 Meridians exercise is useful for organizing stress such as controlling emotion when it is done with convidence, sincerity and patience.

On the other hand emotional control is a kind of someone behavior and its behavior is influenced by self-efficacy. It is as the description of Alber Bandura (in Kendra, 2007) which defines self-efficacy as someone's belief to his ability to succeed in a particular situation.

This study is intended to answer a research question "Is the combination of Wei Chi 14 Meridians exercise and the patient affirmacy able to increase emotional control of self-efficacy?"

### METHOD

This study is categorized as a kind of pre-experimental research with pre-test post-test one group design which is done by one group without any comparison group (Sugiyono, 2011:73) The samples are 41 pre elderly 45-60 years old suffering hypertension and do not suffer bone disorders who live in Sidanegara at the working area of Puskesmas (health community center) in Middle Cilacap.

The sample was taken from purposive sampling. the data gathering used the quetioner of self-efficacy emotional control. The questioner validity used face validity. The intervention Wei Chi 14 meridians exercise was taken twice. The data analyzed by wilcoxon test.

### FINDING AND DISCUSSION.

The average of pretest and posttest score of self efficacy emotional control of the first group describes in the following figure.

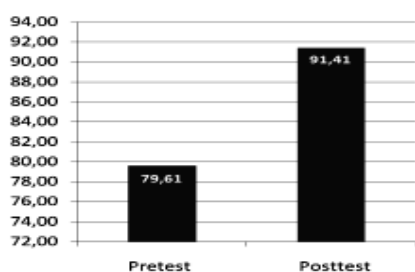


Figure 1. Diagram of the average of pretest and posttest score self efficacy emotional control

The result test based on Wilcoxon Signed Range Test shows p value 0.000 at  $\alpha = 0,05$ . The result proves that p value  $< 0,05$  so  $H_0$  is refused means the combination of Wei Chi 14 Meridians exercise and patient affirmacy are able to increase effectively self efficacy emotional control.

## DISCUSSION

The combination of Wei Chi 14 Meridians exercise and patient affirmacy increase self efficacy emotional control effectively in which is supported by the following factors:

1. Wei Chi 14 Meridians exercise uses a basic movement which possible has effect to emotional control. The Wei Chi 14 meridians exercise was taken from some bases movement as follow:
  - a. Touching through an initial meridian point, some acupuncture pointing areas, some meridian points, and the end of meridian point. This description is in accordance with Field T (2011) statement. He explains that one effect of touching psychology and biochemistry is able to lower the pulse and blood pressure. The decreasing pulse and blood pressure is understandingly as an indicator of having good emotional control. Nathan S. in Preventionindonesia states that Healing touch is a recovery therapy with soft touching which can make the patient calm emotion. McKenzie, Carole A., and Frownfelter, Grant D. (2012) in their research defines touching is able to reduce the level of stress, pain, worry, repairing vital signs, increasing the body immune and attention. Zolfaghari M., Eybpoosh S., and Hazrati M. (2012) defines that therapeutic touching is able to reduce such feeling of worry with  $p < 0.0001$ , decrease the incidence of dysrhythmias with  $p < 0.0001$ , and repair the vital signs into normal  $p < 0.0001$ .
  - b. Moving through meridian's line by hand slowly 2-3 cm above, concentrate the

feeling, and control breathing. The basis of this motion has an effect to control emotion because slowly moving in good concentrating feeling and breathing makes them doing such in their own therapy. This study supports some previous studies such as: Clive J. R., Shian L. K., Andrew G. E., Jeffrey G. B. (2011) find that Mindfulness-based stress reduction (MBSR) reduced the feeling of fear, worry, anger, aggression, and help to overcome the difficulty to control emotion. Feldmana G, Greesonb J, Senville J (2010) explains Mindful breathing and progressive muscle relaxation or both are suggested to be a reliable approach to manage the stress. Busch V., Magerl W., Kern U., Haas J., hajak G., and Eichhammer P. (2011) state that deep and slow breathing technique are both can reduce negative feelings such as tension, anger and depression.

- c. The entire move is done with slow and gentle which belongs to low impact movement. Besides that basic movement, Wei Chi exercise is performed by smile in order to have the sensation of the body and mind relaxation (Sutarno, 2013). This is in line with the finding of Eric C. Anderson, M. Dryman Taylor, John Worthington, Elizabeth A. Hoge, Laura E. Fischer, Mark H. Pollack, Lisa Feldman Barrett, Naomi M. Simon (2013) study; entitled "Smiles may go unseen in generalized social anxiety disorder: Evidence from the binocular rivalry for reduced visual consciousness of positive facial expressions" (taken from Journal of Anxiety Disorders). Eric et al finds that the smiley duration is significantly shorter on generalized social anxiety disorder (GSAD) compares with generalized anxiety disorder (GAD) and the healthy control group. The finding shows that smile happens more in healthy people. From the psychological side, Royce E., IK Timothy, Setiawan I. (2012) state that a smile is able to provide a positive spirit for oneself and others.
2. Wei Chi 14 meridians exercise combining with patient affirmacy. Irwin K. states that affirmation is a continually positive statement and needs to write to form a good positive thinking in mind. In this research, that patient affirmacy is written and spoken during exercise as the voice background with romantic mood instruments. The patient affirmacy is a belief of



being patience, forgiveness, and healthy. Not only it is written in a paper and said, but also written on T-shirt which is wore in exercise.



Figure 2. Patient affirmacy  
Personal document, taken on August 10<sup>th</sup>, 2013

This study supports some previous researches. Schmeichel, Brandon J., Vohs, and Kathleen (2009) defines that self efficacy is able to increase self control. Gooda A. and Abraham C. (2011) states that self affirmacy influences the ability to give good respond to self efficacy.

Besides the previous discussions above, theoretically Bandura, 1998 states that ongoing self efficacy is influenced by four factors. They are: (1) mastery experiences, (2) vicarious experiences, (3) social persuasion, (4) physiological and emotional states.

## CONCLUSION

The combination of Wei Chi 14 Meridians exercise and patient affirmacy is able to increase self efficacy emotional control.

## References

- Apriany, Afrida RE & Tatik. 2012. Asupan protein, lemak jenuh, natrium, serat dan IMT terkait dengan tekanan darah pasien hipertensi di RSUD Teugurejo Semarang. <http://eprints.undip.ac.id/38392/>. Dilihat 04 april 2013.
- Busch V, Magerl W, Kern U, Haas J, Hajak G, dan Eichhammer P. 2012. The Effect of Deep and Slow Breathing on Pain Perception, Autonomic Activity, and Mood Processing—An Experimental Study. *Pain Medicine* Volume 13, Issue 2, pages 215–228, February 2012
- Clive J. R, Shian L. K, Andrew G. E, Jeffrey G. B. 2012. Effects of mindfulness-based stress reduction on emotional experience and expression: a randomized controlled trial. *Journal of Clinical Psychology* Volume 68, Issue 1, pages 117–131, January 2012.
- Eric C. Anderson, M. Taylor Dryman, John Worthington, Elizabeth A. Hoge, Laura E. Fischer, Mark H. Pollack, Lisa Feldman Barrett, Naomi M. Simon. 2013. Smiles may go unseen in generalized social anxiety disorder: Evidence from binocular rivalry for reduced visual consciousness of positive facial expressions. *Journal of Anxiety Disorders*. Volume 27, Issue 7, October 2013, Pages 619–626.
- Feldmana G, Greesonb J, Senville J. 2010. Differential effects of mindful breathing, progressive muscle relaxation, and loving-kindness meditation on decentering and negative reactions to repetitive thoughts. *Behaviour Research and Therapy* Volume 48, Issue 10, October 2010, Pages 1002–1011.
- Field T. 2011. *Touch for socioemotional and physical well-being: A review*. Fielding Graduate University, Santa Barbara, CA 93105, United States <http://www.sciencedirect.com/science/article/pii/S0273229711000025>
- Irwin K. *The Beginners Guide to Affirmations and Visualisation* <http://ezinearticles.com/?The-Beginners-Guide-to-Affirmations-and-Visualisation&id=4237479>. Dilihat 11 Mei 2013
- Kendra. 2007. *What is Efficacy?* <http://psychology.about.com/b/2007/04/24/what-is-self-efficacy.htm>) diperoleh tanggal 12 Februari 2008
- McKenzie, Carole A. dan Frownfelter, Grant D. 2012. Bio-Touch Therapy: Ease of Use in Clinical Patient Care and in Patient/Family Teaching. <http://www.nursinglibrary.org/vhl/handle/10755/243387>
- Muhammadun. 2010. *Hidup Bersama hipertensi*. iN-Books. Yogyakarta
- Puspitorini. 2009. *Hipertensi: Cara mudah mengatasi tekanan darah tinggi*, Image press, Yogyakarta.
- Royce E, Timotius IK, Setyawan I. 2012 Sistem Pendeteksi Senyuman Berdasarkan Metode Edge Detektion, Histogram, Equalization dan Nearest Neighbor Techné *Jurnal Ilmiah Elektroteknika* Vol. 11 No. 1 April 2012 Hal 75–82. <http://www.jurnaltechna.org/archives/201211/201211106-ivn.pdf>
- Samuel J. 2012. Psychosomatic Research in Hypertension: The Lack of Impact of Decades of Research and New Directions to Consider.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- The Journal of Clinical Hypertension. October 2012 Volume 14, Issue 10. Pages 657–735
- Schmeichel, Brandon J, Vohs, dan Kathleen. 2009. Self-affirmation and self-control: Affirming core values counteracts ego depletion. Journal of Personality and Social Psychology, Vol 96(4), Apr 2009, 770-782. doi:10.1037/a0014635.  
<http://psycnet.apa.org/journals/psp/96/4/770/>
- Sugiyono 2011. Metodologi penelitian kuantitatif kualitatif dan R&D Alfabeta. Bandung
- Susilo dan Wulandari. 2011. Cara jitu mengatasi hipertensi. Andi. Yogyakarta
- Sutarno 2013. Rancang bangun senam wei chi 14 meridian yang berpotensi meningkatkan kesehatan masyarakat. Proseding Seminar & Presentasi Ilmiah Konggres Nasional II. IPKKI.
- Terapi Healing Touch.  
[http://preventionindonesia.com/article.php?channel=health/emotional\\_health&name=/terapi-healing-touch](http://preventionindonesia.com/article.php?channel=health/emotional_health&name=/terapi-healing-touch)
- Zolfaghari M, Eybpoosh S dan Hazrati M. 2012. Effects of Therapeutic Touch on Anxiety, Vital Signs, and Cardiac Dysrhythmia in a Sample of Iranian Women Undergoing Cardiac Catheterization: A Quasi-Experimental Study. <http://jhn.sagepub.com/content/early/2012/07/23/0898010112453325.abstract>

## THE EFFICIENCY OF GARLIC AND CUCUMBER CONSUMPTION IN DECREASING THE BLOOD PRESSURE AMONG THE ELDERS WITH HYPERTENSION

Priyo<sup>1</sup> Prita Oktafiyana<sup>2</sup>

Faculty of Health Sciences, Magelang Muhammadiyah University

### *Abstracts*

*One of the health problems of elders that tends to increase is hypertension. Patients with hypertension tend to choose pharmacological therapy despite the fact that actually there are many types of traditional medicinal plants that are less expensive, easy, affordable and have no side effect such as cucumbers and garlands. This study aimed to search the difference of the effects of the consumption of onions and cucumbers in decreasing the blood pressure among the elders in the village of Deyangan, the work area of Puskesmas in Mungkid City. The research design used in this study was quasy experiment with three group pre-post test design. The total population of this study were 90 people. The sampling method used was purpoive sampling method. The treatment was conducted during 12 days. The results showed that there was a decrease in blood pressure after the treatment using cucumber, garlic or the combination of garlic and cucumber. The analysis result for 7 day treatment using Anova test showed the systolic pressure with  $P < 0.07$ , which meant there was a difference among the three therapies, but there was no significant difference in diastolic pressure with  $P < 0.689$ . On other hand, the analytical result of 12 day therapy showed that there was no difference among the three therapies for both systolic pressure ( $P < 0.361$ ) and diastolic pressure ( $P < 0.879$ ). Further analysis for 7 day treatment proved that there existed a group that was significantly different, i.e the treatment using garlands with garlands and cucumbers. However, for 12 day treatment, there was no significant difference among the three therapies. Health workers, especially nurses in the community are expected to provide an alternative therapy for mild and moderate hypertension by consuming cucumbers or garlands.*

**Keywords:** *garlic, cucumberr, hypertension, elders*

### INTRODUCTION

Advances in science and technology in the field of health has increased the life expectancy. It results in the increase of the number of the elder

people. Nowadays, the number of elders in the worldwide is estimated at over 629 million people (1 in 10 people aged over 60 years old). In 2025, it is estimated to achieve 1.2 billion people. The increasing number of the elder population brings about the degenerative diseases, one of which is hypertension (Wahjudi. 2008).

Hypertension, often so called 'The Silent Killer' is a disease that many people in the community are suffered and is the highest cause of mortality and morbidity. In the United States and some other developed countries, hypertension occurs in about one in four adults in the ages of 18s and one in two people in the ages over 50 years old. Moreover, men have higher risk of suffering from the high blood pressure up to age of 55 years old. Meanwhile, the risk of high blood pressure among the women was

at the age of 75 years or more (Bejo, 2004).

Ikhtiarsyah et al (2012) reported that the prevalence of hypertension in Indonesia ranged from 8.6% to 10%, or an estimated of 15 million people. The prevalence among adults was 6%-15% from the total population and 50% of which were unaware as hypertension sufferer and it tended to be more serious hypertension and 90% of people with hypertension were of unknown cause hypertension/essential.

Based on data Riskesdas (*Riset Kesehatan Daerah*) of Central Java (2007), it was noted that the prevalence of hypertension in Central Java was 37.0% and in Yogyakarta was 35.8%. The prevalence of hypertension according to respondent characteristics, seemed to increase in accordance with the increase of respondents's age: aged 55-64 years old (53.7%), aged 65-74 years old (63.5%), and the age of 75 years old or more (67.3%). The Health Profile of Central Java Province (2011) stated that the prevalence of essential hypertension in Central Java was 1.96%. One of the regions in Central Java which had the highest prevalence of hypertension of 10% was in Magelang Regency i.e 22.41% of the total population. Secondary data of Deyangan village, the working area of Puskesmas in Mungkid City (2012), it was stated that the hypertension perevalence ranked the second after

respiratory diseases of 5%, which was 2% of residents suffered from essential hypertension or hypertension of unknown cause.

Garlic, in Latin named *Allium Sativum L*, can be used as an alternative choice of herbal medicine to control hypertension. Garlic contains an active substance of alliacin that can react to prevent blood clots and decreasing the blood pressure. The consumption of garlic in hypertension patients won't cause significant side effects on other organs (Anonym. 2012).

Cucumber is a kind of vegetables that has a Latin name *Cucumis Sativus*. Empirically, the cucumber has many advantages, one of which is to overcome high blood pressure (Mambo, 2006). The researches on the benefits of cucumbers were not only conducted in Indonesia but had also been have conducted in China by Zhong Zi (1991) using cucumber herb tablets. The result showed that the tablets of cucumber herb had an effect that can be seen on the increase of coronary blood flow and improved the myocardial contraction.

## RESEARCH METHODS

This research is an experimental study with quasi-experimental research design (Nursalam,

2003). The blood pressure of subjects in each group was measured before and after treatment using three group pre-post test design. The sampling technique used was purposive sampling technique. During the research, the number of samples obtained was as much as 90 people.

During the intervention phase, group 1 received a therapy with a glass of cucumber juice (i.e. 200 ml or 150g); group 2 received a therapy with 10 g of garlic juice; and group 3 was provided with the combination of garlic and cucumber juice. After intervention, the blood pressure of the subjects in each group was measured.

## RESEARCH RESULTS

The following is the distribution of the average reduction in blood pressure after treatment and the distribution of difference groups with the therapy using cucumber juice, garlic juice and the combination of garlic and cucumber juice.

### 1. The Characteristics of respondents

The characteristics of the respondents were classified according to the range of respondents' age and gender. The distribution of frequency of the respondents' characteristics is shown in table 1.

Table 1. The Distribution of Respondents' Characteristics by Age and Sex in Patients with Hypertension in Deyangan Village, the working area of Puskesmas in Mungkid, Magelang Regency in 2013 ( n = 90 )

Characteristics	Number	%
1. Age		
a. 56-60 y.o	40	44
b. 61-65 y.o	21	23
c. 66-70 y.o	7	8
d. 71-75 y.o	12	13
e. 76-80 y.o	8	9
f. 81-85 y.o	1	1
g. 86-90 y.o	1	1
2. Sex		
a. Male	14	14
b. Female	76	76

### 2. The Decrease in Systolic Blood Pressure

The average of the decrease in systolic blood pressure after the treatment using cucumber juice, garlic juice and the combination of garlic and

cucumber juice in the patients with hypertension in Deyangan village, the work area of Puskesmas Mungkid in Magelang regency is shown in table 2.

Table 2. Mean Decrease in Systolic Blood Pressure in Patients with Hypertension in Deyangan Village, the Work Area of Puskesmas Mungkid in Magelang Regency in 2013 ( n = 90 )

The length of therapy	Variable	Mean	SD	95% CI	P value
7 days	Cucumber Therapy	39,4333	19,30461	32,2249-46,6418	0,027
	Garlic therapy	49,8667	30,58593	38,4457-61,2876	
	Therapy of garlic and cucumber	34,6000	12,21531	36,5427-46,0573	
12 days	Cucumber Therapy	65,9667	31,98004	54,0251-77,9082	0,361
	Garlic therapy	73,3000	38,26780	59,0106-87,5894	
	Therapy garlic and cucumber	61,0000	29,26455	50,0724-71,9276	

### 3. The Decrease of Diastolic Blood Pressure

The average drop in diastolic blood pressure after the therapy using cucumber juice, garlic juice and the combination of garlic and cucumber juice in

hypertension patients in Deyangan village, the work area of Puskesmas Mungkid in Magelang regency is shown table 3.

Table 3. Mean Decrease in Diastolic Blood Pressure in Patients With Hypertension in the Deyangan Village, the Work Area of Puskesmas Mungkid in Magelang Regency in 2013 ( n = 90 )

Length of Therapy	Variable	Mean	SD	95% CI	P value
7 days	Cucumber Therapy	24,2333	20,46643	16,5910-31,8756	0,563
	Garlic therapy	28,3000	18,76194	21,2942-35,3058	
	Therapy of garlic and cucumber	26,6333	15,28462	20,9260-32,3407	
12 days	Cucumber Therapy	32,9333	30,43131	21,5701-44,2966	0,879
	Garlic therapy	31,0333	32,71031	18,8191-43,2476	
	Therapy of garlic and cucumber	29,0000	26,41577	19,1362-38,8638	

### 4. The Difference among the Three Groups of Cucumber Juice Therapy, Garlic Juice Therapy, and the Combination of the combination of Garlic and Cucumber Juice Therapy

The Difference among the Three Groups of Cucumber Juice Therapy, Garlic Juice Therapy,

and the Combination of the combination of Garlic and Cucumber Juice Therapy among the patients with hypertension in Deyangan village, the work area Puskesmas Mungkid, Magelang regency is described in table 4.

Table 4. The Difference of Group Therapy in Systolic and Diastolic Blood Pressure by Bonferroni Test after 7 Days Therapy in the Patients with Hypertension in Deyangan Village, the Work Area of Puskesmas Mungkid, Magelang Regency in 2013 (n = 90)

	Variabel		Mean Difference	Std Error	95% CI	P value
Sistole	Cucumber Therapy	Garlic	10,4333	5,69089	-24,3257-3,4590	0,211
		Garlic & Cucumber	4,8333	5,69089	-9,0590-18,7257	1,000
	Garlic Therapy	Cucumber	10,4333	5,69089	-3,4590-24,3257	0,211
		Garlic & Cucumber	15,2667	5,69089	1,3743-29,1590	0,026
	Therapy of Garlic & Cucumber	Cucumber	-4,0667	5,69089	-18,7257-9,0590	1,000
		Garlic	15,2667	5,69089	-29,1590- -1,3743	0,026
Diastole	Cucumber Therapy	Garlic	-4,0667	4,72465	-15,6002-7,4669	1,000
		Garlic & Cucumber	-2,40000	4,72465	-13,9336-9,1336	1,000
	Garlic Therapy	Cucumber	4,0667	4,72465	-7,4669-15,6002	1,000
		Garlic & Cucumber	1,6667	4,72465	-9,8669-13,2002	1,000
	Therapy Garlic & Cucumber	Cucumber	2,430000	4,72465	-9,1336-13,9336	1,000
		Garlic	-1,6667	4,72465	-13,2002-9,8669	1,000

## DISCUSSION

The result of the study showed that in the elders who were provided with the therapy for 7 days or 12 days consuming cucumber juice, garlic juice, and the combination of garlic and cucumber juice, there was a decrease in systolic and diastolic blood pressure. For 7 day therapy, it showed that there was a difference in the decrease of blood pressure but after 12 day therapy, there was no difference in the systolic blood pressure among the three therapies. Meanwhile, for the diastolic pressure, there was no significant difference among the three therapies for both of 7 day therapy and 12 day therapy.

The result of this study was in accordance with Bangun (2004) which stated that a glass of cucumber juice contained 2.6 mg of calcium, 6 mg sodium/sodium and 168 mg potassium/potassium (Build 2004). The kalium supplements (potassium) of 2-4 grams per day could decrease the blood pressure (Purnomo, 2009). The consumption of potassium in the right portion could prevent the negative effect of sodium on blood pressure (Muchtadi, 2009).

Potassium is able to decrease the blood pressure by causing vasodilatation, causing a decrease in total peripheral retention and increase cardiac output. Potassium intake will increase the concentration in the intracellular fluid that tends to pull fluid from the extracellular and decreases the blood pressure (Amran Y et al, 2010, in Kusnul & Munir, 2012). Potassium supplement can lower the blood pressure by dietary supplementation of potassium 60-120 mmol/day so that it can lower systolic and diastolic blood pressure of 4.4 and 2.5 mmHg in patients with hypertension and 1.8 and 1.0 mmHg in normal people (Saraswati. S, 2009, in Kusnul & Munir, 2012).

Low plasma potassium levels will stimulate aldosterone to lower blood volume so that the cardiac output decreases (Corwin, 2009). Cucumber therapy will be able to lose one's weight and reduce sodium that has been proved in one of the effective interventions on the hypertension in the elder population (Consensus of Indonesian Hypertension Association, 2009).

The content of cucumber is also diuretic because of the high water content which helps decrease the blood pressure. Diuretics serves to remove the excess of fluid in the body (Murwani, 2011). Cucumbers have very low calorie content that can lose weight (Build, 2004). Cucumber is easy to digest and facilitates urination (diuretics) for hypertension (Rukmana, 2012). Diuretics lighten the workload of the heart function by

increasing the water and salt excretion and lower the concentration of the amount of fluid in the bloodstream (Ridwan, 2009). Garlic is one of the suitable therapy for elders. One of the causes of hypertension is due to the loss of elasticity of the blood vessels which may result in the increase of vascular resistance that causes the increase of blood pressure (Nugroho, 2008). While the content of the main components of garlic is allicin i.e. diallyl disulfide trisulfida and allyl methyl. Decomposition of allicin may react with blood and serves to stretch the blood vessels, causing blood vessel dilation and easy flowing.

Another ingredient of garlic is ajoene. It has an important role as an agent of antiaggregation platelets and lowering cholesterol levels. S-allyl cysteine synthesis will inhibit NF- $\kappa$ B and LDL oxidation associated with atherosclerosis (Heinrich, Barnes, Gibbons & H. Williamson, 2005). Ajoene has similar way of working as aspirin, which inhibits fibrinogen receptors on platelets, although in lower labor effectiveness. Moreover, garlic contains active substances of vinyl dithiols. It is a bioactive component in garlic that has a very important role, that is as an agent of antiaggregation blood platelets or prevents vein thrombosis (Najmuddin, 2012).

Research conducted by Alicajic (2009) in Darmadi and Riska (2012), it was explained that the study of 30 patients with mild and moderate hypertension to determine the efficiency of garlic as a mild and moderate hypertension management. The 30 patients were provided with 3 cloves of garlic per day (about 10 grams of garlic could lower the systolic blood pressure of an average of 9.52%, and for the diastolic blood pressure of an average of 10.42%. The treatment of garlic extract could lower the systolic blood pressure of  $11.8 \pm 5.4$  mmHg (Ried, Frank, & Stock, 2012). Yuniati, Rahmalia and Arneliwati (2012), concluded that garlic infusion therapy and 12.5 mg of captopril therapy were very effective in lowering high blood pressure both in diastolic and systolic. Darmadi and Ruslie (2005), stated that garlic was very well tolerated by the body and could be used as a dietary for hypertension intervention strategy.

In general, the blood pressure depends on the heart rate, stroke volume, and TPR, so that the increase in one of the components that is not compensated can cause hypertension (Corwin, 2009).

Garlic as one of the therapy has stronger effect in lowering blood pressure compared to the other therapies for the elders with hypertension. One of the causes that makes the elders suffer from high

blood pressure is due to the loss of blood vessel elasticity which may result in the increase of vascular resistance and causes blood pressure increase Nugroho, 2008).

When the blood pressure rises, the cells smooth muscles will reduce the release of renin and when the plasma sodium levels increase, the macula densa cells give the signal to the smooth muscle cells to decrease the release of renin. At the time of the renin-angiotensin circulates in blood, it will convert angiotensinogen to angiotensin I. Then, angiotensin I quickly reacts with angiotensin - converting enzyme into angiotensin II, which serves as a vasoconstrictor to increase smooth muscle contraction and an increase in systemic total peripheral resistance and stimulates the adrenal cortex to produce aldosterone. Low plasma potassium level also inhibits the secretion of aldosterone which causes the decrease of blood volume so that the cardiac output decreases (Ridwan, 2009).

## CONCLUSION

Most of the respondent characteristics were aged of 56-60 years old, i.e. 44%. And according to its sex, most of the subjects were of female gender, i.e. 76%. In the groups of respondents who were provided with the treatment of cucumber juice, garlic juice, and the combination of garlic and cucumber juice, there was a decrease in both systolic and diastolic blood pressure.

The groups of respondents who received the treatment during the 7 days of cucumber, garlic, and garlic therapy, there was a significant difference in systolic blood pressure and after 12 days treatment, there was no significant difference obtained. Whereas after 7 days or 12 days of therapy, there was no difference in diastolic blood pressure. Groups of respondents who were provided with the treatment for 7 days which was significantly different was the therapy of garlic with garlic and cucumber. After 12 days treatment there was no significant different.

The need for health workers, especially nurses who give cucumbers or garlic therapy in elders with hypertension is customized to the client wishes as an alternative therapy before medical therapy so that people can reach out and empower independently. However, further research is to examine the content of the pulp of cucumber as other therapies and experimental research contents reaction cucumbers and garlic on blood pressure reduction.

## References

- Anonymous. (2012). Nutrition Value of Garlic - Garlic. Jakarta Rineke Copyright
- Anwar S & Andriani I. (2010). Relationship Analysis Demographic factors and the occurrence of injury Hypertension in the Elderly at Posbindu Sun RW 09 New urban city west Jakarta, Journal of medicine and health, University of Muhammadiyah Jakarta, 2 (6), p. 129.
- Arikunto. (2006). Research Procedures. Jakarta: Rineka Reserved.
- Aziza L. (2007). Hypertension, The Silent Killer, Jakarta: Indonesian Medical Association Foundation Publishing.
- Bandiyah, S. (2009). Seniors and Nursing Gerontik, Yogyakarta: Musha Medika.
- Bejo. (2004). Hypertension. Indomedia: Jakarta
- Corwin, E, J. (2009). Pathophysiology pocket book. Jakarta: EGC
- Darmojo B., Martono H., (2006). Geriatrics 3rd Edition. Hall Publishers Faculty of Medicine, University of Indonesia. Jakarta.
- Darmadi and Riska. (2012). Role of Garlic Against Hypertension. Journal Volume. I. No.2. Oktober.2012. FK UKSW
- Darmadi & Ruslie R.H. (2005). Role of Garlic (*Allium sativum*) Against Hypertension, Hospital. Pagar Alam, District Right Way. Lampung. Journal of Hospital Z.A. Pagar Alam, district Way Kanan, Lampung
- Goddess. S & Familia. D. (2010). Happy Living with Hypertension. A Plus: Jogjakarta, February.
- Djamilahnajmuddin. (2012). Efficacy Garlic. Library onlain
- Heinrich, Barnes, Gibbons & H. Williamson. (2005). Pharmacology and Fitoterapi, Jakarta: EGC
- Ikhtiarsyah et al. (2013). Garlic (*Allium sativum*). Journal Online Pharmacy. UGM
- Intersalt, (2009). International Study of Sodium, Potassium and Blood Pressure,WHO.
- Kusnuh Z, Munir Z, (2012). Cucumber juice Against Giving Effect Decreased Blood Pressure, Stikes Bahr Ulum, Email: zauhani.kusnul@yahoo.com
- Indonesian Society of Hypertension Consensus. (2009). Management of Hypertension in Special Circumstances: Hiperetnsi in the elderly, Jakarta Indonesian Society of Hypertension.
- Listyani W.S. (2004). Connect Leaf Life - Plant Alternatives for Hypertension.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Mambo. (2006). Kasiat Cucumber. Online journal. University Press.
- Muchtadi, D. (2009). Introduction to Nutrition. New York: Alfabeta.
- \_\_\_\_\_. (2009). Anti Aging Nutrition. New York: Alfabeta.
- Murwani, A. (2011). Patient Care Medicine. New York: Goshen Pulishing
- Nugroho, W. (2008). Nursing Gerontik & Geriatic, Jakarta: EGC
- Nursalam, (2003). Concept and Application of Nursing Research Methodology. Salemba Medika. Jakarta.
- Purnomo, H. (2009). Prevention & Treatment of the Most Deadly Disease, New York: Library Buana.
- Ried, K, Frank OR, Stocks NP. (2012). Aged garlic extract Reduces blood pressure in hypertensives, European Journal of Clinical Nutrition, [www.nature.com / ejcn](http://www.nature.com/ejcn)
- Ridwan, M. (2009). Know, Preventing, Fighting, Coronary Heart Silent Killer, Semarang: Library Widyamara.
- Health Research. (2007). Tenga Java statements. Central Java Provincial Health Office.
- Saraswati. S. (2009). Healthy diet for gout disease, diabetes, hypertension, and stroke.
- Septi Sprott. (2011). 14 Most Frequently Disease and Very Deadly Attack. Flash Book. Jakarta
- Solanki.P (2011). Nutritional Value of Cucumber, Rineka, Jakarta
- Yumiati, Rahmalia S, Arneliwati. (2012). Comparative Effectiveness of Garlic infusion with captopril to Decrease Blood Pressure In Patients with Hypertension, Nursing Science University of Riau, Email: [yumiati\\_latty16@yahoo.com](mailto:yumiati_latty16@yahoo.com)
- Zhi Z.Z. (1991). Clinical and Experimental Study of Cucumber Vine Compound Tablets in Treating Essential Hypertension. [www.pubmed.com](http://www.pubmed.com).



## IS THERE A DIFFERENCE BETWEEN FISALIN STANDARDIZED EXTRACT FROM *PHYSALIS ANGULATA* L AND CONTROL ON PANCREATIC FUNCTION OF SPRAGUE DAWLEY RAT INDUCED BY STREPTOZOTOCIN-NICOTINAMIDE?

Yeny Sulistyowati<sup>1</sup>, Sri Kadarsih Soedjono<sup>2</sup>, Mustofa<sup>2</sup>, Budi Mulyono<sup>2</sup>

### Abstract

**Background:** Diabetes mellitus (DM) is a metabolic disorder of carbohydrate, fat, and protein characterized by chronic hyperglycemia conditions. Oxidative stress due to hyperglycemia in patients with diabetes may fasten the process of pancreatic tissue damage. *Physalis angulata* L or Ciplukan herb is one of Indonesian medicinal plants that has been used traditionally and empirically proven as an antidiabetic.

**Objective:** To determine whether there is a difference between fisalin standardized extract from *Physalis angulata* L and control on pancreatic function of Sprague Dawley rat induced by Streptozotocin-Nicotinamide.

**Method:** The study is true experimental research design with a post-test only control group design. The subjects of this study are 32 male Sprague Dawley rat induced by Streptozotocin and Nicotinamide. The extract is given a dose of 20 mg / kg for 21 days. At the end of the study, pancreas organs are taken for histological preparations and make the observed diameter of the islets of Langerhans. Normality test data Kolmogorov Smirnov is to determine the differences analyzed by t-test.

**Result:** There was a significant difference between the diameter of the islets of Langerhans treatment and control group ( $p = 0.001$ ).

**Conclusion:** The provision of fisalin standardized extract from *Physalis angulata* L at a dose of 20 mg / kg BW can repair the size of the islets of Langerhans.

**Keywords:** Diabetes Mellitus, *Physalis angulata* L (Ciplukan herb), pancreatic function.

### BACKGROUND

Diabetes mellitus (DM) is a metabolic disorder of carbohydrate, fat, and protein caused by decreased insulin secretion, decreased tissue sensitivity to insulin, or both (WHO, 1999; Cubbon et al, 2007). Prevalence of the world's population suffered from diabetes in 2000 is estimated about 150 million people (Saraswati, 2009). For Indonesia, the World Health Organization (WHO)

predicts the increase in the number of people from 8.4 million in 2000 to 21.3 million in 2030 (Perkeni, 2006). Meanwhile, the International Diabetes Federation (IDF) predicts that the number of people with diabetes in Indonesia from 7 million in 2009 increase to 12 million in 2030 (Perkeni, 2011).

Conditions of hyperglycemia in diabetes will cause long term damage and failure of various organ functions. Frequent complication of diabetes mellitus is divided into two major subtypes, namely diabetes-specific microvascular complications and macrovascular complications (Heydari et al, 2010). Oxidative stress and hyperglycemia due to insulin resistance in patients with diabetes may fasten the process of  $\beta$ -pancreatic cell damage (Buchanan et al, 2002).

The high cost of therapy makes the herbs as the alternative for people with diabetes. In addition, many natural products and herbal medicines are recommended as the treatment of diabetes mellitus (Jung et al, 2006). Indonesian medicinal plants that have been used traditionally and empirically proven as an antidiabetic, among others: gardenia, bitter, noni, vinca, ciplukan, etc. (Widowati et al, 1997).

Ciplukan herb (*Physalis angulata* L) has been used as antiaterosklerotik (Anggraini, 2009), antibacterial (Guimaraes et al, 2009), anticancer (Fauzi et al, 2011), asthma medication (Rathore et al, 2011) and antidiabetic (Sediarso et al, 2008; Sutjiatmo et al, 2011; Sulistyowati et al, 2013). Antidiabetic effects of Ciplukan herb occurs because the chemical constituents of this plant, such as unsaturated fatty acid, alkaloids, flavonoids, saponins, polyphenols, steroids and triterpenoids, monoterpenoid, and sesquiterpenoid (Sediarso et al, 2008; Sutjiatmo et al, 2011; Choi and Hwang, 2005).

Effects of Ciplukan herb (*Physalis angulata* L.) as a potential antioxidant against pancreatic function in diabetic people has not been known. Based on the results of existing studies, it is necessary to investigate whether there is a difference between fisalin standardized from *Physalis angulata* L and the control on pancreatic

function of Sprague Dawley rat induced by Streptozotocin-Nicotinamide.

## METHOD

This study is true experiment with post-test only control group design using control and treatment groups. The subject of the study is a male rats strain Sprague Dawley. This research was conducted in the Laboratory of Pharmacology and Toxicology Faculty of Medicine, University of Gadjah Mada as the manufacture of herbal extracts Ciplukan. Preparation of pancreas histofisiologi is conducted at Anatomical Pathology of the Faculty of Medicine, Gadjah Mada University. Maintenance of animals is conducted in LPPT 4 University of Gadjah Mada. The observations of the pancreas histofisiologi is conducted in Histology and Cell Biology Faculty of Medicine, Gadjah Mada University.

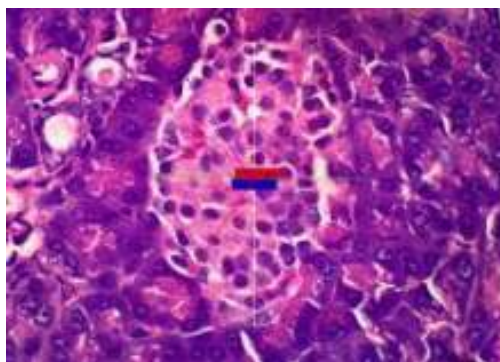
The independent variable in this study is giving fisalin standardized from *Physalis angulata* L, a dose of 20 mg/kg BW and the dependent variable is histology of the pancreas. Uncontrolled confounding variables are the subject of research,

Ciplukan herb and maintenance. Subjects of the study include 32 male rats strain Sprague Dawley weighing range 160-200 g aged 3 months. Animal made STZ-induced diabetes by means of a dose of 45 mg/kg BW in intraperitoneal. Diabetes Mellitus rats expressed when blood sugar levels > 100 mg/dL pp (Ahmed, 2005; Srinivasan and Ramarao, 2007; Aragno et al, 2011). Giving Nicotinamide is much as 110 mg/kg BW is given 15 minutes before administration of STZ. Ciplukan herb treatment was given for 21 days then on day 22, the animals euthanized for pancreas histofisiologi. Histological observation of the pancreas uses histofisiologi test with hematoxylin and eosin staining technique and observations of the diameter of the islets of Langerhans (Jellies and Makiyah, 2011), with 40x magnification.

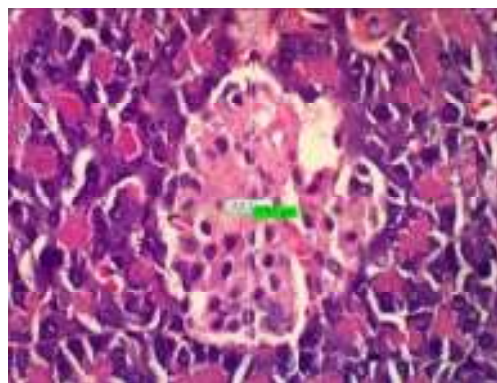
Diameter of the islets of Langerhans is statistically analyzed. Analysis of the data in the form of test data normality with the Kolmogorov Smirnov. Different test between the control and treatment groups is analysed by independent t test trials.

## RESULT AND DISCUSSION

### Microscopic Histology of the Islets of Langerhans



DM group without Ciplukan herb  
(Control group)



DM group with Ciplukan herb  
20 mg/kg BW (Treatment Group)

Figure 1. Microscopic histology of the islets of Langerhans picture with 40x magnification

Based on Figure 1, it can be seen that the microscopic picture of the histology of the pancreas (islets of Langerhans) control group showed abnormalities which are round and elongated autolysis. Microscopic picture of group I, showing the form that is normal islets of Langerhans are oval and endocrine cells appear to degenerate density compared to the control group and the other treatment.

### The Difference between the Diameter of the islets of Langerhans Treatment and Control Group

Histological observation of the pancreas uses histofisiologi test with hematoxylin and eosin staining techniques. The mean diameter of the islets of Langerhans can be seen in table 1.

Based on Table 1 it can be seen that the average diameter of the islets of Langerhans control group is 265.88  $\mu\text{m}$  (SD  $\pm$  27.09), the mean diameter of the islets of Langerhans group with

herbal treatment Ciplukan 20 mg/kg body weight is 354.89  $\mu\text{m}$  (SD  $\pm$  42.16). The normality test performs on the mean diameter of the islets of Langerhans of data using Kolmogorov Smirnov statistical test with a significance  $> 0.05$ .

Statistical analysis of data showed the average diameter of the islets of Langerhans were normally distributed ( $p = 0.74$ ). Different test between the control and treatment groups by t-test statistical test showed no significant difference ( $p = 0.001$ ).

Table 1. The Mean Diameter of the Islets of Langerhans between the Control and Treatment Group

Groups	Dose of standardized fisalin from <i>Physalis angulata</i> L	The mean diameter of islets of Langerhans ( $\mu\text{m}$ )	p (Anova)
Control	Without extract	265,88 $\pm$ 27,09	0,001*
Treatment	20 mg/kg BW	354,89 $\pm$ 42,16	

\*  $p < 0.05$  = significant

The pancreas is a gland that produces hormones (insulin and glucagon), digestive enzymes, and bicarbonate are secreted into the duodenum to aid digestion (Sullivan, 2004). Patients with type 2 diabetes mellitus, chronic decline in the function of pancreatic  $\beta$  cells in the form of a decrease in the number and diameter of the islets of Langerhans resulting in decreased insulin secretion. Decreased function of the pancreas due to an imbalance of antioxidants and free radical or oxidative stress due to the state of chronic hyperglycemia (Moussa, 2008).

In this study, the condition of hyperglycemia in experimental animals given injections done by Streptozotocin (STZ) at a dose of 45 mg/kg BW. Streptozotocin a diabetogenic substances that are cytotoxic to pancreatic  $\beta$  cells (Takasu et al, 1991; Ahmed, 2005). After STZ induced, animal adapted for 3 days and were treated for 21 days. Day 22 after treatment of experimental animals euthanized for histological preparations.

Histological preparations are conducted using hematoxylin and eosin staining techniques for observation of the shape and diameter of Langerhans. The results of measurements of the diameter of the islets of Langerhans is being an indicator of the extent of damage to the pancreatic endocrine cells of experimental animals after STZ induced and after being given Ciplukan herb extract for 21 days treatment. Islets of Langerhans have properties dependent plasticity of pancreatic  $\beta$  cell mass in them. There for the diameter of the islets of Langerhans is directly proportional to the amount and mass of  $\beta$  - cells of the pancreas (Bernard et al, 1999 in Ridwan et al, 2012).

Statistical analysis of the diameter of the islets of Langerhans, shows that there are significant differences between the control and treatment groups ( $p = 0.001$ ). Based on the microscopic appearance histology pancreas, islets of Langerhans control group show abnormalities which are elongated shape and smaller than the treatment group. While the treatment group Ciplukan herb

dose 20 mg/kg BW show Langerhans islets in the shape and the diameter is larger than the normal control. Changes in the shape and diameter of the islets of Langerhans control group occurred due to an increase in free radical production after STZ - induced pancreatic tissue damage resulting.

The increase in free radical production after induction of STZ describes the pathogenesis of the condition of hyperglycemia in chronic type 2 diabetic patients. The increase in free radical production is being offset by an increase in the concentration of antioxidants leads to oxidative stress. Oxidative stress of the patients with diabetes can lead to various complications and pancreatic tissue damage.

The imbalance between free radicals and antioxidants can lead to oxidative stress (Muchtadi, 2009). In patients with chronic type 2 diabetes mellitus, oxidative stress can lead to microvascular and macrovascular complications (Heydari et al, 2010). Complications occur mainly in the form of impaired cardiovascular function of endothelial dysfunction and atherosclerosis (Watskin, 2003; Johansen et al, 2005).

The study is consistent with research conducted by Oberley (1998). The increase in free radicals after induction of STZ leads to pancreatic tissue damage within 2-4 days after induced. Increased pancreatic tissue damage will continue if there is a condition of uncontrolled hyperglycemia. Conditions of chronic hyperglycemia in diabetes may increase the production of free radicals and reactive oxygen species (ROS). Research Kaneto et al (1999), shows the same thing that chronic hyperglycemia can increase oxidative stress that can damage  $\beta$ -cells of the pancreas. Oxidative stress can also lower the amount of glucose transporter (GLUT) in the blood resulting in an increase in insulin resistance. In addition, the lack of insulin signaling due to oxidative stress can decrease the synthesis and secretion of insulin by  $\beta$ -cells of the pancreas.

Based on the results of this research conducted Sulistyowati et al (2013) show that in the control group there was an increase in blood sugar levels, from 333.62 mg/dL increased to 403.03 mg/dL. Increased blood sugar levels due to decreased insulin secretion by  $\beta$ -cells of the pancreas. It is proven by the diameter of the islets of Langerhans in the control group under normal.

The results of research in the treatment group show a different histological features of the pancreas with a control group based on the shape and diameter of the islets of Langerhans ( $p = 0.001$ ). The statistical result of the giving fisalin standardized extract from Ciplukan herb on pancreatic histology shows significant difference ( $p = 0.001$ ). Water extract of Ciplukan herb in the group treated with a dose of 20 mg/kg BW could prevent the destruction of pancreatic tissue of experimental animals after STZ induced. Mechanism of action of water extract Ciplukan herb in maintaining the function of the pancreas after induction of STZ has not been known.

However, it is predicted because of the effect of the active compounds contained in herbal Ciplukan, namely alkaloids, flavonoid, steroids, saponins, polyphenols, teriterpenoid, monoterpenoid and seskuiaterpenoid, unsaturated fatty acids and fisalin.

Fisalin a steroid derived compounds (secosteroid) with high antioxidant activity that can prevent the occurrence of oxidative stress. Fisalin contained in Ciplukan herb can increase

enzyme activity superoksidase dismutase (SOD) and catalase (El-Mehiry et al, 2012). Dismutase and catalase enzymes superoksidase an enzymatic antioxidants can protect cells or tissues and organ systems of the body from free radicals and ROS (Winarsi, 2007). Antioxidants work by providing a rapid hydrogen atom to the radical compound that turns into a more stable compound (Percival, 1998).

Similar results were also shown by the results of the study of El-Mehiry, et al (2012), showed that the antioxidant extract of fisalin can increase enzyme activity superoksidase dismutase (SOD) and catalase. Increased activity of SOD and catalase enzyme able to reduce levels of protein oxidation and lipid peroxides. There is a balance between oxidants and antioxidants are able to prevent damage to the cells of the pancreas.

Research Kaneto et al (1999) shows that DM treatment with antioxidants can prevent oxidative stress and are able to maintain cell function of pancreas. Oxidative stress occurs due to the condition of uncontrolled hyperglycemia can

damage  $\beta$ -cells of the pancreas that decreased synthesis of insulin. Antioxidant treatments on DM are able to protect cells from the pancreatic  $\beta$ -oxidative stress and maintain  $\beta$ -cell function of the pancreas.

Results of research conducted Sulistyowati et al (2013) show that the administration of the dose variation Ciplukan herb can lower blood sugar levels after giving treatment group treated for 21 days. The decrease in blood sugar levels in the treatment group shows that pancreatic function can be maintained in the group. This is proven by histology islets of Langerhans that the treatment is better than the control group.

## CONCLUSION

Microscopic structure of rat pancreas in the treatment group size is larger than the control. The mean diameter of the islets of Langerhans in the control group is  $26.88 + 27.09$ , while the treatment group is  $354.89 + 42.16$ . There is a significant difference islets of Langerhans in the control group and the treatment ( $p = 0.001$ ).

Based on the results, it is recommended to determine the diet that can affect energy and nutrient intake. Creating the form checklist aspects of diabetes symptoms of polyphagia, polydipsia, and polyuria will be conducted next research. It will be better to determine the effects on other biochemical parameters and organ others, such as the kidney, aorta and heart.

## References

- Ahmed, R, G. 2005. The Physiological and Biochemical Effects of Diabetes on The Balance Between Oxidative Stress and Antioxidant Defense System. Medical Journal of Islamic World Academy of Sciences. 15(1): 31-42.
- Anggraini, M., Haryono, K., Habibie. 2009. Potensi Antiaterosklerotik Herba Ciplukan (*Physalis angulata* L) dengan Uji Sintesis Proinflamatori dan Aktivitas Penghambatan Oksidasi LDL. Jurusan Farmasi : Universitas Hasanudin.
- Aragno, M., Parola, S., Brignardello, E., Manti, R., Betteto, S., Tamagno, E., Danni, O., dan Bocuzzi, G. 2001. Oxidative Stress and Eicosanoids in the Kidney of Hyperglycemic Rats Treated with Dehydroepiandrosterons. Free Radical Biol Med. 31(8): 935-42.
- Buchanan, Thomas A., Anny H. Xiang., Ruth K. Peters., Siri L. Kjos., Aura Marroquin., Jose Goico., Cesar Ochoa., Sylvia Tan., Kathleen Berkowitz., Howard N. Hodis., dan Stanley P. Azen. 2002. Preservation of Pancreatic  $\beta$ -Cell

- Function and Prevention of Type 2 Diabetes by Pharmacological Treatment of Insulin Resistance in High-Risk Hispanic Women. *Diabetes*. 51: 2796-2803.
- Choi, Eun-Mi dan Jae-Kwan Hwang. 2005. Effect of Some Medicinal Plants on Plasma Antioxidant System and Lipid Levels in Rats. *Phytotherapy Research*. 19(5): 382-6.
- Cubbon, RM., Adil, R., dan Stephen, BW. 2007. The Impact of Insulin Resistance on Endothelial Function, Progenitor Cells and Repair. *Diabetes and Vascular Disease Research*. 4:103-111.
- El-Mehiry, Hanaa F., H, M, Helmy., dan M, A, Abd El-Ghany. 2012. Antidiabetic and Antioxydative Activity of *Physalis* Powder or Extract with Chromium in Rats. *WJMS*. 7(1): 27-33.
- Fauzi, I. Agusta., Fikri, A., Nurma, S., Adam, H., Muthi, I., dan Edy, M. 2011. Aktivitas Antiproliferasi Ekstrak Etanolik Herba Ciplukan (*Physalis angulata* L.) Terhadap Sel Hepar Tikus Betina Galur Sprague Dawley Terinduksi 7,12-Dimetilbenzena. *Majalah Kesehatan Pharma-Medika*. 3(1): 194-199.
- Guimaraes, E, T., Milena, S, L., Luana, A, S., Ivone, M, R., Therezinha, B, C, T., Ricardo R, S., Washington, L, C, S., dan Milena B, P, S. 2009. Activity of Physalins Purified from *Physalis Angulata* in In Vitro and In Vivo Models of Cutaneous Leishmaniasis. *J Antimicrob Chemoth*. 64: 84-87.
- Heydari, Iraj., Vida, R., Sara, R., dan Afsaneh, A. 2010. Chronic Complications of Diabetes Mellitus in Newly Diagnosed Patients. *Int J Diabetes Mellit*. 61-63.
- Jelies, Mutiana Muspita dan Nurul Makiyah. 2011. Pengaruh Pemberian Infusa Tumbuhan Sarang Semut (*Hydnophytum formicarum*) Terhadap Gambaran Histologi Pankreas Pada Tikus (*Rattus norvegicus*) Diabetes Terinduksi Aloksan. *Majalah Kesehatan PharmaMedika*. 3(1): 200-3.
- Johansen, Jeanette S., Alex, K, H., David, J, R., dan Adviye, E. 2005. Oxidative Stress and the Use of Antioxidants in Diabetes: Linking Basic Science To Clinical Practice. *CVD*. 4(5): p1-p11.
- Jung, Mankil., Moonsoo, P., Hyun, C, L., Yoon-Hoo, K., Eun, S, K., dan Sang, K, K. 2006. Antidiabetic Agents from Medicinal Plants. *Curr. Med Chem*. 13: 1203-18.
- Kaneto, Hideaki., Yoshitaka, K., Jun-Ichiro, M., Taka-Aki, M., Yoshio, F., Yutaka, U., Toshiaki, H., Yuji, M., Yoshimitsu, Y., dan Masatsugu, H. 1999. Beneficial Effects of Antioxidants in Diabetes; Possible Protection of Pancreatic  $\beta$ -cells Againsts Glucose Toxicity. *Diabetes*. 48: 2398-2406.
- Moussa, S, A. 2008. Oxidative Stress in Diabetes Mellitus. *Rom. J Phys*. 18(3): 225-236.
- Muchtadi, Deddy. 2009. Gizi Anti Penuaan Dini. Bandung : Alfabeta.
- Oberley, L, W. 1988. Free Radicals and Diabetes. *Free Radical Bio Med*. 5(2): 113-24.
- Percival, Mark. 1998. Antioxidants. *Clinical Nutrition Insights*. 31: 1-4.
- Perkumpulan Endokrinologi Indonesia. 2006. Konsensus Pengelolaan dan Pencegahan Diabetes Mellitus Tipe 2 di Indonesia. Perkumpulan Endokrinologi Indonesia.
- , 2011. Konsensus Pengelolaan dan Pencegahan Diabetes Mellitus Tipe 2 di Indonesia. Perkumpulan Endokrinologi Indonesia.
- Rathore, Chhaya., K, R, Dutt., Shobharam, S., dan Lokesh Deb. 2011. Antiasthmatic Activity of the Methanolic Extract of *Physalis angulata* Linn. *J Med Plants Res*. 5(22): 5351-55.
- Ridwan, Ahmad., Raden T. Astrian., dan Anggraini Barlian. 2012. Pengukuran Efek Antidiabetes Polifenol (Polyphenon 60 ) Berdasarkan Kadar Glukosa Darah dan Histologi Pankreas Mencit (*Mus musculus* L.) S.W. Jantan yang Dikondisikan Diabetes Mellitus. *Jurnal Matematika dan Sains*. 17(2): 78-83.
- Saraswati, Sylvia. 2009. Diet Sehat untuk Penyakit Asam Urat, Diabetes, Hipertensi, dan Stroke. Yogyakarta : A Plus Books.
- Sediarso., Hadi, S., dan Nurul, A. 2008. Efek Antidiabetik dan Identifikasi Senyawa Dominan dalam Fraksi Kloroform Herba Ciplukan (*Physalis angulata* L.). *Jurnal Farmasi Indonesia*. 4(2): 63-69.
- Srinivasan, K dan P, Ramarao. 2007. Animal Model in Type 2 Diabetes Research: An Overview. *Indian Journal Medical Research*. 125: 451-472.
- Sullivan, Robert James. 2004. Digestion and Nutrition. USA : Infobase Publishing.
- Sulistyowati, Y., Septriana, Rafika., M. 2013. Effect of Water Extract Herbs Ciplukan (*Physalis angulata* L) on Blood Sugar and Lipid Profile of Sprague Dawley Male Rats Injected By Streptozotocin and Lipopolysaccharide. Abstract book of Asia Pacific Congres of Clinical Nutrition. Jepang.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Sutjiatmo, A, B., Elin, YS., Yulia, R., Suswini, K., Asri, W., dan Suci, N. 2011. Efek Antidiabetes Herba Ciplukan (*Physalis angulatas* LINN.) pada Mencit Diabetes dengan Induksi Aloksan. *Jurnal Farmasi Indonesia*. 5(4): 166-171.
- Takasu, Nobuyuki., Ichiro Komiya., Takayuki Asawa., Yoshitaka Nagsawa., dan Takashi, Y. 1991. Streptozocin- and Alloxan-Induced H<sub>2</sub>O<sub>2</sub> Generation and DNA Fragmentation in Pancreatic Islets: H<sub>2</sub>O<sub>2</sub> as Mediator for DNA Fragmentation. *Diabetes*. 40(9): 1141-1145.
- Watskin, Peter J. 2003. ABC of Diabetes. Edisi ke-5. London : BMJ Publishing.
- Widowati, L., B, Dzulkarnain., dan Sa'roni. 1997. Tanaman Obat untuk Diabetes Mellitus. *Cermin Dunia Kedokteran*. 116: 53-60.
- World Health Organization. 1999. Definition, Diagnosis and Classification of Diabetes Mellitus and its

## PHENOMENOLOGY STUDY OF HELPLESSNESS ELDERLY EXPERIENCE WITH HYPERTENSION IN BOGOR CITY

<sup>1</sup>Abdul Wakhid, <sup>2</sup>Achir Yani S. Hamid, and <sup>3</sup>Yossie Susanti Eka Putri

Phone/Fax: +6224-6925407

Email: <sup>1</sup>abdul.wakhid2010@gmail.com, <sup>2</sup>ayanihamid@yahoo.co.id,  
<sup>3</sup>yossie\_putri@yahoo.com

### **Abstract**

*Hypertension was a major and serious problem. In 2020, predicted 23,6 million people will die because of CVD, particularly heart disease and stroke (WHO, 2008). Hypertension was a chronic disease that requires the handling of blood pressure management of long condition that could trigger the emergence of depression and helplessness.*

*The objective was to explore the experience of helplessness in elderly who got hypertension in Bogor city.*

*The method of this research was used qualitative descriptive phenomenology method to 6 participants. Participant are elderly was experienced helplessness with hypertension. Data analysis was used Collaizi step.*

*The finding was revealed theme of physical, social, psychological response, acquiring social support, reframing helplessness, seeking spiritual support, passive appraisal, mobilized family to acquire and accept help, hoped against disease condition.*

*Conclusion the describe of helplessness response in elderly patients with hypertension found the theme of physical responses, social responses, and psychological responses. Coping mechanisms in elderly patients who had obtained the theme of powerlessness acquiring social support, mobilizing family to acquire and accept help, seeking spiritual support, reframing the conditions and passive appraisal.*

**Keywords:** *elderly, hypertension, helplessness*

### **BACKGROUND**

In 2050, the estimated population in the world by age more than 65 years increased twice and individual with 85 years to up increased fourth-fold (Varcarolis, Carson & Shoemaker, 2006). The increasing of elderly should be offset by the increasing of attention for elderly because will appear body systems changes as the result of aging process. World health organization (WHO) describes a chronic disease as long duration

symptom and slow development and describes chronic condition as health problem requires continuously management for year period or decades (WHO, 2002)

Hypertension symptom is known as the heterogeneous group of disease because it can attack anyone of various age and socio-economic groups. Hypertension is often called the silent killer; because a person can suffer hypertension for years without realize it until vital organs get severer damage and even lead to death.

In facing the hypertension symptom that needs long-term management is needed adaptive coping mechanism so elderly can serve their old age phase happily and prosperous and doesn't fall to maladaptive condition due to chronic symptom. Adaptive coping mechanism is carried out as the effort to prevent the development stressor becomes maladaptive condition that lead to elderly get helplessness to their symptom. The condition of elderly who experienced hypertension symptom in the Baranangsiang village Bogor city as much as 1,45% of 24.187 inhabitants in Baranangsiang village.

### **METHODS**

The design of this study used a phenomenological qualitative research approach with descriptive approach and phenomenological approach. Participants or sample of this study was elderly who experienced helplessness due to hypertension. The numbers of sample involved in this study were 6 people. The location of this study was RW 05, Baranangsiang village, Eastern Bogor district, Bogor city. The study was done in December 2011.

In-depth interview was done for 50-90 minutes. Data analyzes used the steps of analyze from Colaizzi, (1978) in Streubert & Carpenter (2003) with making verbatim transcription, reading transcription continuously, collecting significant revelation, determining the meaning of every important revelation, grouping into category, the those was arranged into sub theme and grouping into theme that referred to the objective research.

## RESULT

Participants of this study were elderly people who suffered helplessness due to hypertension. Participants consisted of three men and three women with average age 70,5 years. The education level of them varied, ranging from elementary school, junior high school and senior high school. All participants lived with their family. Duration of

the participants got disease were various such as one and a half year (first participant), three years (second participant), four years (third participant), five years (fourth and sixth participants) and six years (fifth participant).

More details characteristic of participants were listed in table 1.

Table 1. Participant characteristic

No participant	Gender	Age	Education	Blood pressure (mmHg)	Duration suffering from hypertension
P1	Male	69 years	Senior high school	180/90	1.5 years
P2	Male	74 years	Senior high school	200/120	3 years
P3	Male	67 years	Junior high school	160/90	4 years
P4	Female	68 years	Elementary school	170/90	5 years
P5	Female	74 years	Elementary school	170/120	6 years
P6	Female	71 years	Junior high school	180/90	5 years

Obtained from participant's experience during facing helplessness due to hypertension.

### 1. The picture of helplessness experience response due to hypertension

#### a. Physical response

Participant experience about physical response was the condition that was likely occur as hypertension condition experienced by participant.

*"A few days ago I was little difficult to do activities, headache, body felt limp sir..." (P3)*

*"... dizziness only wanted to lie down Sir, but it was also difficult to sleep" (P4)*

*"... didn't do homework, a lot of silent, lied down, but his body was getting weakness Sir, it was like powerlessness Sir" (P5).*

#### b. Social response

The limitation in following social activities could be experienced by the elderly who got powerlessness due to hypertension.

*"....long time ago was used to join religion activities every week, or helped neighbor if there was salvation or other activity....lately was seldom Sir, I also felt not comfort with my family..." (P4)*

#### c. Psychological response

Psychological response was perception related to emotional changes experienced to helplessness condition due to hypertension. A variety of psychological responses that

emerged was fear, anger, sadness, fell discomfort and anxious.

*"....Yes Sir yesterday was increase again. I was also afraid because my feet felt mild, it seem not on the ground Sir, luckily there was my child at home...." (P5)*

*"In addition to this dizziness Sir, felt afraid to do household because worried to fall, so I was silent and nothing to do...." (P6)*

*"....then when I had a lot of thinking felt discomfort, it was difficult to do activities Sir..." (P4)*

*"....yes felt sad, confused too Sir, felt can't do anything if thought this condition....so my neck felt heavy Sir...." (P4)*

*"....didn't want to get angry, ordinary, but it's not angry that I've ever done but it's only wanted, not until angry..." (P1)*

*"...scared if hypertension happened, I forced to do activity but suddenly it was dropped.." (P1).*

*"...also scare Sir, if not drink for too long, afraid if the kidney had problem later..." (P6)*

### 2. The description of elderly coping mechanism experience with powerlessness due to hypertension.



- a. Acquiring social support  
The experience of seeking social support was gotten by participants, they expressed their experience to get social support about seeking health solution was not enough from themselves but it also got from the other.  
*"...look for solution should not only from ourselves but also from other..." (P2)*

*"...all my children was far Sir, I ever asked my neighbor favor... (if the participants had his recurrent hypertension, participants asked their neighbor favor) (P3)*

- b. Reframing  
The other participant's experience in implementing coping mechanism to his powerlessness due to hypertension was re-interpreted.  
*"...well if all household was done, I could take a rest, played with grand children, so my mind will be comfort Sir..." (P5)*

- c. Seeking Spiritual support  
Helplessness condition due to hypertension made participant did activities to make closer to god.  
*"....still strong to do night prayer, asked Allah to cure illness, I considered all this ordeal for me.." (P4)*

*"....also worried, but I think all this one was trial from god, I only prayed hope Alloh SWT to cure my illness..." (P3).*

- d. Passive appraisal  
The experience obtained subsequent coping mechanisms of the participants were passive assessment. Assessment of passive defense is a defensive mechanism.  
*"....when did that condition (hypertension), just wanted to stay at home, felt lazy for going anywhere..." (P1)*

*"I only gave all to God, also prayed, I only wanted to Alloh, hopefully given health condition....." (P4)*

*".....didn't go to public health service routinely, last time was early this year...." (P3).*

- e. Mobilizing family to acquire and accept assistance

Obtained four participants who used herbal medicine to reduce symptoms of hypertension experienced.  
*"... I usually boil my starfruit leaves and I'll drink water boiled..." (P3)*

*"... I drank cucumber water, sometimes boiled water to drink starfruit leaves, Yes Sir...only drunk traditional medicine..." (P4)*

*"... Well try not to heavy thinkers, heavy pack..." (P6)*

- f. Expectations of the condition of the disease  
As human beings lived in a social environment, the expectation of disease conditions would make a motivation for changing. The experience of powerlessness, not block participants to have a motivation in doing everyday activities.  
*"... I hope my disease get well no more high blood pressure..." (P1)*

*"... Wanted it... I was still able to do this, but now I felt this body weight..." (P3)*

## DISCUSSION

### The theme of physical response

Physical response of elderly with hypertension was consistent with the results of research conducted by Webb et al (2006) who found a picture of elderly with hypertension underwent some changes such as changes in diet, lack of regular activity, and increased body weight. But the existence of regular physical activity, described by the research Luckson (2008), is one of the efforts made for the management of hypertension in the elderly.

It could be concluded that in elderly patients suffering from hypertension helplessness, needed to do a variety of physical activities that could still be done regularly as one of the efforts to manage hypertension and also as a means to fill the spare time so that the elderly had a physical activity that could be done to fill his spare time.

### The theme of social response

This study was in line with research done by Manzini & Simonetti (2009) that patients with hypertension were found to have a variety of changes in the pattern of his life. In their study, found it was difficult to maintain behaviors to meet their needs, including changes in activities that create feelings of pleasure, changes in social interaction and lifestyle changes.

It could be concluded that participants who experience helplessness due to hypertension tend to have difficulty in social interaction due to an increase in blood pressure resulting in meeting the needs of the participants experienced a change in general, including changes in social interaction. Therefore be made to assist participants in overcoming the problems of social interaction by facilitating formation of support groups (*self help group*) among the elderly neighbor who suffered from helplessness due to hypertension.

#### **Themes of psychological response**

Sherina, Rampal, and Mustaqim (2004) states in their research, the cause or risk factors for depression in the elderly were a health issue, treatment, fear of death, and worried about issues related to the disease they experienced. Participants expressed sadness because they experienced hypertension requiring treatment or continuous treatment. The pain felt by the participants due to complaints of illness appear to be especially severe and fears of complications that may make him difficult.

In this study, which appears anxious perceived by participants who felt anxious about the condition of disease and drug effects that arose when did treatment with chemical drugs. Worried about the effects of treatment, it made the participants left the chemical drugs and put through anticipating problems with herbal medicines.

In this study, fear, sadness, and anxiety were experienced by many women participant. While the participants were mostly men experience feelings of anger and anxiety.

#### **The theme of acquiring social support**

The presence of social support with research Rachma (2010) in this study because the location of the research was conducted at the same setting, that was the community setting, so that participants feel more of an acquired form of social support from neighbors or from family members.

#### **Reframing condition of powerlessness**

This study was in line with the study Wong *et al* (2005) that the presence of hypertension made the respondent recall and got closer to God, because it considered that the disease was experiencing was God's punishment for what he had done. In addition to consider the disease as a punishment from God, the participant also made the presence of hypertension as a trigger for the spirit to live the life they face.

#### **The theme of seeking spiritual support**

The same thing was also obtained by Wong *et al* (2005) who examined the compliance of treating hypertension in the U.S. population of respondents had obtained close to the behavior of various spiritual activities during his life.

Based on this, the researchers concluded that spiritual support was an attempt to divert attention from the state hospital or transferred to state the problem to the material problem to spiritual so one's mind didn't focus continually on the condition but it could develop the thinking further ahead, that life would not be only the end of the world. Spiritual support was an effort coping mechanisms that could be done by anyone in the face of conditions or behaviors.

#### **The theme of passive appraisal**

According to Chow and Cummings (2000), was the interpretation of passive assessment of environment and situation in adapting to the behavior. Defense mechanism *defensive* manner will result in a person's failure to gain experience and skills in dealing with others, the result would be social doubts and limiting the ability of consciousness (Semun, 2006).

It could be concluded that these coping mechanisms could be used elderly who had suffered from helplessness due to hypertension, so it would help to increase self-awareness to accelerate the aging or elderly easier accept his condition. It depends on one's ability to adapt.

#### **The theme of Mobilize the family to acquire and accept help**

This study was in line with research conducted by Moulton (2009), who found that African Americans did not respond well to anti-hypertensive drug, so caution was needed for nurses at the time described the treatment program, although it was not unreasonable to use dose combination treatment.

Anticipation was activities where a person take action to prevent the occurrence of undesirable events. Results of this study was slightly different from the research conducted Li, Wallhagen and Froelicher (2007) who studied the control of hypertension was found that the effective management of the condition of hypertension and the benefits to prevention of complications need to be developed adequately. Control of hypertension was an attempt to determine the development of hypertensive conditions they experienced, whether stable, declining or even increase.

This study was done after the participants made efforts to seek the help of professionals or health

care facility. But for some reason there is no change of condition, age and inability to reach health care facilities then attempt another alternative that can still be done is to use existing resources in the environment.

#### **The theme of hope against the disease condition**

The last theme was encapsulated in this study was the expectation of disease conditions. The results illustrated the participants who had chronic hypertension had hope to be able to return to daily activities, had better conditions than before, the symptoms of hypertension did not appear again or always in normal range. Statement was often came when a person suffered from a disease for long time / so needed chronic continuous treatment.

The study was in line with the study Wong et al (2005), found that respondents believed they experienced hypertension was a disease that would be experienced throughout the period, so that respondents could still hope to address with an activity that could be done independently at the moment did not show symptoms of hypertension. In this study also found the same expectations with the study Wong et al (2005) that participants could return to their activities.

Based on these results, it could be concluded that the condition did not preclude a person helpless to have desire in performing daily activities and continue his life. It's just the conditions of powerlessness made a person was unable to achieve these desires.

#### **CONCLUSION**

The describe of helplessness response in elderly patients with hypertension found the theme of physical responses, social responses, and psychological responses. Coping mechanisms in elderly patients who had obtained the theme of powerlessness acquiring social support, mobilizing family to acquire and accept help, seeking spiritual support, reframing the conditions and passive appraisal. The elderly hope to his illness was gotten the themes of elderly hope against the disease condition.

#### **References**

- Aziza, L., (2007), *Hipertensi the silent killer*, Yayasan Penerbitan Ikatan Dokter Indonesia
- Chow, T.W., & Cummings, J.L., (2000), *Neuropsychiatry: Clinical assessment and approach to diagnosis*. Philadelphia, Lippincott Williams & Wilkins.
- Li, W.W., Wallhagen, M.I., & Froelicher, E.S., (2007), *Hypertension control, predictors for medication adherence and gender differences in older Chinese immigrants*, Journal compilation, Blackwell Publishing, Ltd. California.
- Luckson, M., (2009), *Hypertension management in older people*, British Journal of Community Nursing, Vol 15, No 01.
- Manzini, F.C., & Simonetti, J.P., (2009), *Nursing consultation applied to hypertensive clients: application of Orem's self care theory*. Revista Latino-Americana de Enfermagem (RLAE), Universidade de Sao Paolo.
- Moulton, S. A., (2009), *Hypertension in African American and its chronic disease*, Journal of Cultural Diversity, Vol 16 No 4, Tucker Publication. Toronto.
- Rachma, N., (2010), *Pemahaman mendalam tentang arti dan makna pengalaman lansia dalam melakukan perawatan tekanan darah tinggi di Kelurahan Ngesrep, Kecamatan Banyumanik, Kota Semarang Jawa Tengah*, Tesis FIK UI, Tidak di Publikasikan.
- Semiun, Y., (2006), *Kesehatan mental*, Kanisius, Yogyakarta.
- Sherina, M.S., Rampal, L., & Mustaqim, A. (2004). *Factors associated with chronic illness among the elderly in a rural community. Asia pasific journal of public health*. Vol 16. no. 2. April 6, 2011. <http://aph.sagepub.com/cgi/content/abstract/16/2/109>.
- Streubert, H.J. & Carpenter, D.R., (2003), *Qualitative research in nursing: Advancing the humanistic imperative*, third edition, Lippincott William & Wilkins, Philadelphia.
- Varcarolis, E.M., Carson, V.B., & Shoemaker, N.C., (2006), *Foundation of psychiatric Mental health nursing a clinical approach*. Missouri: saunders elsevier.
- Webb, M.S., & Gonzales, L.O., (2006), *The Burden of Hypertension: Mental Representations Of African American Women*, Issues in mental health nursing, Taylor & Francis Group, LLC USA.
- WHO, (2002), *Innovative Care for Chronic Conditions: Building Blocks for Action*. World Health Organization, Geneva, Switzerland.
- WHO, (2008), *Technical brief for Policy Maker*, Geneva, Switzerland.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

Wong, C.C., et al, (2005), *Adherence with  
hypertension care among hmong Americans,*  
*Journal of Community Health Nursing,*  
Lawrences Erlbaum Associates, Inc.  
California.

## PROFILE OF JOB SATISFACTION AND ITS EFFECT ON CARING BEHAVIOR OF HOSPITAL NURSES

Jebul Suroso<sup>1)</sup>

<sup>1)</sup> Lecturer Faculty of Health Science of Muhammadiyah University of Purwokerto

### Abstract

*Performance of nurses in delivering nursing care is influenced by job satisfaction. Caring behaviors as a part of performance of the nurses is needed in order to create quality of care and patient satisfaction. Purpose of the descriptive-correlation research is to identify relationship between job satisfaction of nurse and caring behaviors. The research used cross-sectional approach and it involved 46 nurses at a private hospital of Purwokerto. Results of univariate analysis showed that over half of the respondents were less satisfied, also similar proportions of nurses who felt to have caring behavior and those with less caring behavior in providing nursing care. Results of bivariate tests using Chi Square stated that there is a correlation between job satisfaction and caring behaviors of nurses ( $p$  value = 0.006). Logistic regression testing indicated an effect of job satisfaction on caring behavior. Nurses who were satisfied had a chance of 5.6 times greater to behave caringly than those who had less caring behavior. More information can be explained, any increase of the job satisfaction score will enhance caring behavior of nurses as much as 1.732. Based on these results, the hospital management should be able to create job satisfaction among its nurses through improved work organization, compensation and restructuring nursing career. Training for caring behavior is also needed in order to maintain and improve the quality of care to patients.*

**Keywords:** job satisfaction, caring, nurses

### BACKGROUND

Quality of health care of hospitals is mainly determined by Human Resources (HR) providing the health services. Most of the health care providers are nurses at the hospital, so quality of nursing care can be a picture of the quality of health care in general (Swansburg, 2000).

A quality nursing care must be able to respond to various needs of patients by promoting a service culture in form of caring behavior in providing a nursing care to patients. Caring is an embodiment of nurse's professional attitude and a part of patient's interest and satisfaction-oriented

professional performance of the nurses. Creation of this condition requires large contribution on the part of nursing management in managing a nursing service, especially in attempts of improving performance of nurses.

Attitude and behavior of a nurse as performance are affected by several factors. A research by Lukman (2007) explained that the performance is affected by leadership, ability, and compensation. Nurse's performance is also influenced by organizational culture including work demands, work support, interpersonal relationships and physical work environment (Burdahyat, 2009). According to Juliani (2009) the caring behavior is influenced by nurse's workload. While, a research by Surosos (2011) stated there is a significant correlation between job satisfaction and performance of nurse.

Job satisfaction is an assessment parameter on a worker about the extent to which his job is satisfied his/her needs as a whole (As'ad, 2008). A positive job satisfaction can improve a working performance and it has positive effect on the company. Job dissatisfaction, on the other hand, is a negative attitude which can degrade the performance of the work, so that it could hurt the company.

Several aspects of a job affecting job satisfaction of nurse and they had been studied rigorously are leadership style, salary or payment, promotion opportunities, the superior or leader, fringe benefits, rewards, rules and procedures of work, coworkers, communication and type of work (Nurhayati, 2007). Recognition and a good working climate among nurses and other professions such as doctors can reduce stress and increase job satisfaction of nurses working in hospitals (Tabak, N. & Koprak, O., 2007).

Location of the research is a type C private hospital which is located about 2 km westward of Purwokerto town. No research/assessment on nurse's job satisfaction was conducted in the hospital previously. Related to patient satisfaction, then the hospital had conducted a survey of community/patient satisfaction index (CSI) in June 2011. Score data of the patient satisfaction based on the CSI survey was 77.4 (Suroso, 2011). This result

is actually belonged in category B or good, but some of other hospitals in Banyumas and surrounding areas set a limit of CSI with a score of more than 85 and even 90 (Predicate A). Result of survey was also revealed that patient dissatisfaction factor was partly caused by lack of responsive attitude of nurses (13.7%), in the case can be referred to as a lack of caring behavior of nurses in delivering of services.

Previous studies suggested that service performance can be affected by the job satisfaction of nurses. Researcher assumed that the nurse's caring behavior is likely influenced by the job satisfaction. Therefore, it is necessary to find a definitive answer from the assumptions of the researcher, as stated in the problem statement: how does profile of job satisfaction and its effect on nurse's caring behavior.

## METHODE

The research is a descriptive-correlational one with cross sectional design aiming to examine correlation between job satisfaction and nurse's caring behaviors in a Private Hospital of Purwokerto. The research was conducted from January to March 2012. Population of the research is 50 nurses and sample of the research is 46 respondents. Data is collected by using a questionnaire asking about job satisfaction and caring behaviors of nurses. Analysis of the data uses univariate and bivariate analyses with chi-square test and multivariate logistic regression.

## RESULT AND DISCUSSION

### 1. Profile of Job Satisfaction of Nurses Working in a Private Hospital of Purwokerto

Table 1. Job Satisfaction of nurses working in a private hospital of Purwokerto of 2012 (N=46)

Variable	Frequency	Percentage (%)
Job Satisfaction		
Less satisfied	27	59
Satisfied	19	41
Total	46	100
Subvariables :		
Organizational culture and values		
Less satisfied	24	52
Satisfied	22	48
Career Opportunity		
Less satisfied	29	63
Satisfied	17	37
Leadership		
Less satisfied	24	52
Satisfied	22	48
Working Activity		
Less satisfied	37	80
Satisfied	9	20
Compensation		
Less satisfied	39	85
Satisfied	7	15

Based on table 1 it can be explained that more than a half of nurses working in RSI of Purwokerto had less job satisfaction (59%). It was followed by statement of nurses saying less satisfied with the organizational culture and values (52%), less satisfied with career opportunities (63%), less satisfied with the leadership (52%), less satisfied with work activities (80%) and less satisfied with compensation (85%). Job satisfaction in the research is defined as an assessment on job satisfaction of working nurses in terms of organizational culture and values, career opportunities, leadership, working activities, and compensation.

Hospital of the research is a private one of type C owned by a foundation ownership and the foundation has set rights of the hospital's nurses that are likely not similar with that of nurses of other hospitals in Banyumas Regency. The differences may occur in salary, benefits, and other rights determined in accordance with policies of each hospital management. With such understanding, it can be understood if there are almost similar proportions of those who are satisfied and dissatisfied.

In line with this, the Equity Theory developed by Adams (1963, in As'ad, 2008) states that feelings of satisfaction or dissatisfaction is depending on the sense of equity or inequity to an existing situation, by comparing it with others or in elsewhere.

Total nurses who were satisfied with their job at the hospital amounted to 41%. It was slightly different amounts with those who were unsatisfied. The different satisfaction levels of each nurse is agreeing with Hasibuan's opinion (2009) explaining that individual satisfaction levels are varied according to the value system applied to him. Further, he explained that job satisfaction is considered results of an employee's experiences in relation to his/her own values as what is required and expected from his/her job.

These results are consistent with a survey conducted by McClosky (1974, in Gillies,1996) maintaining that job satisfaction among nurses is influenced by psychological reward factors such as opportunity to attend an educational programs, career advancement opportunity, recognition from colleagues and supervisors, opportunity to participate in a research, additional job responsibilities, increases of salary, additional time off and better working hours.

A similar statement strengthening results of the research is proposed by Crawford, et al (1993, in Ilyas 2002) explaining that job satisfaction is

influenced by a harmonious relationship between personnel and supervisor, career development opportunity, job security and staffing and adequate job stress. In addition to opinions of two experts above, Swansburg (2000) explained that nurse's job satisfaction factor include, among the others, staff development and administrative support factor.

Based on the findings, management of the hospital should be able to take real steps in making policies for improving job satisfaction of nurses in the hospital environment. Policies to be taken should also consider the needs of nurses and existing data in accordance with results of the research and also to take into account the three major aspects of nurses' job satisfaction that are lacking, namely compensation, work activities and career opportunities. Therefore, hospital management should pay attention to the three aspects, for example, by reviewing incentives, setting the workload and making improved arrangement about career level of nurses.

Career development is also recognized as a factor correlating with job satisfaction according to Crawford et al (1993, in Ilyas 2002) stating that the factors of job satisfaction include harmonious relationship between personnel and supervisor, an opportunity of career development, job security and staffing and adequate job stress. Moreover, according to Swansburg (2000), job satisfaction factors include factors of wage and benefits; philosophy of staff arrangement, administrative tasks, shift lending and exchange; professionalism; interdisciplinary relations; public relations; development of staff and administrative support factor.

Job satisfaction according to Marquis and Huston (2010), among others, can also be created through a program of staff development. Therefore, management can anticipate a decreased job satisfaction of nurses with career planning early for all nurses. Hence, it is expected that the older age caregivers, the more established career and higher level of their job satisfaction.

Measures that will be taken by the hospital management should be based on extensive researches including considering results of the study and it is expected that they will increase percentage of nurses who are satisfied than less satisfied. However, all components of the hospital should be aware that an individual satisfaction is subjective depending on how does one making an adaption between expectation and reality. It is agreeing with the theory of dissonance (Discrepancy Theory) by Locke (1969, in As'ad 2008). Considering the theory, however, the

satisfaction is determined not only by hospital management, but also nurses who play a role of feeling satisfied or not in their workplace, and ultimately the satisfaction will likely also impact on the performance and caring behavior of the nurses

## 2. Caring Behavior of Nurses Working in A Private Hospital of Purwokerto

Table 2. Nurses' Caring Behavior of A Private Hospital of Purwokerto of 2012 (N=46)

Variable	Frequency	Percentage (%)
Caring Behavior of Nurses		
Less caring	23	50
Caring	23	50
Total	46	100

Based on table 2, it can be explained that there was similar proportions of nurses who behave in caring and less caring attitudes, namely, 50% respectively.

Taking into account the caring behavior of nurses in the private hospital of Purwokerto in which proportions of those with caring behavior and with less caring were almost equal. Thus, there are two things that could be paid attention, namely, half of the nurses stating that they had behaved caringly in providing nursing care their patients, so it may be a basic advantage to be able to realize the quality of care leading to patient satisfaction.

On the other hand, when we found that half of the nurses behaved less caringly in providing nursing care to patients, then it should be considered by the hospital management in attempts of improving nurse caring behavior.

According to Watson (1988 in Tomey, 1994), a caring is a humanly knowledge, the core of ethical nursing practice and philosophy. The essence of nursing based on values of kindness, attention, love of self and others as well as respect for one's spiritual dimension. Saying caring is not simply behavior, but it is also a meaningful way to motivate action (Tomey, 1994).

The hospital management should increase the caring attitude and behaviors because they can make actions of nurses are not only to meet physical needs, but also provide emotional attention while improving security and safety of clients. The attitude is given with honesty, trust, and good intention. The caring behaviors of nurses will help clients in enhancing positive changes in aspects of physical, psychological, spiritual, and social.

## 3. Correlation Between Job Satisfaction and Caring Behavior of Nurses of Private Hospital of Purwokerto

Table 3. Correlation between Job Satisfaction and Caring Behavior of Nurses Private hospital of Purwokerto of 2012 (N=46)

Variable	Caring Behavior of Nurses				Total N	p value	OR (95% CI)
	Less Caring		Caring				
	N	%	N	%			
Job Satisfaction							
Less satisfied	18	66,7	9	33,3	27	0,006	5,6 (1,53-20,5)
Satisfied	5	26,3	14	73,7	19		

Table 3 showed that 73% of the nurses were satisfied with their job and to have caring behavior. They are greater than those who were satisfied with their job but have no/less caring behavior (26.3%). The difference is significant, with p-value = 0.006 ( $\alpha = 0.05$ ). It means that there is a significant correlation between job satisfaction and nurse's caring behaviors. Noting that OR value = 5.6, then the nurses who were satisfied with their job have opportunity of 5.6 times greater to show caring behavior in providing nursing care to patients in the private hospital of Purwokerto.

There is a significant correlation between profile of job satisfaction and caring behavior of nurses. This is in line with previous research conducted by Suroso (2011) stating that there is a correlation between job satisfaction and performance of nurses. In this case, it can be stressed again that caring behavior of nurses in providing nursing care to patients is a part of the nurse's performance.

Performance is evident from real work of employees work, either individually or in groups, which can be measured according to standardized quality and quantity of work within an organization. Performance is a real form of success or failure of employees referring to the act of achieving and implementing of a demanded task. One's performance can be evaluated through performance assessment in order to see if employees had conducted their tasks in accordance to their duties and responsibilities.

The final stage of multivariate analyzes modeling is shown in Table 4 below resulting in a logistic regression equation to explain probability of the nurses' caring behavior referring to the logistic equation:

Table 4. Final Result of Logistic Regression Multivariate Analysis Variables Relating to Caring Behavior of Nurses of Private Hospital of Purwokerto of 2012

Variable	B	P value	OR	95% CI
Job Satisfaction	1,723	0,009	5,6	1,53-20,50
Constant	-2,416	0,013	0,089	

It can be explained that every increase of the job satisfaction score will improve the nurses' caring behavior as much as 1.723. Job satisfaction has strong effect on the emergence of caring behavior of nurses. Findings of the research indicated that nurses who were satisfied with their job will show chance of 5.6 times greater than those who are less satisfied to indicate caring behavior in providing nursing care to patients in the hospital. Moreover, each increase of the job satisfaction score means an improvement of 1.723 in nurse's caring behavior of the hospital.

Considering that the caring behavior in providing nursing care is an important part in being able to provide a quality nursing care, then it is necessary to improve caring behavior of the nurses. In the research, job satisfaction of nurses may affect improvement of caring behavior of the nurses in delivering nursing care.

Therefore, the hospital management should perform strategic efforts in order to enhance job satisfaction of nurses, and ultimately, it can improve nurse caring behaviors. Job satisfaction can be created, among the others, by making a career system, organizing work activities, and setting compensation according to expectations of nurses.

While, caring behavior itself can be created directly, for example, by conducting a training on caring behavior. Doing the two things simultaneously, namely, to enhance job satisfaction of nurses and to conduct guidance/training on caring behavior, it is expected that a culture of caring in the hospital can be created effectively. The expected ultimate goal is to create a quality nursing services and patient satisfaction, which in turn, will increase patient visits further at the hospital

## CONCLUSION

Profile of job satisfaction of nurses in a private hospital of Purwokerto was found to have similar proportions of those who were satisfied and less satisfied. There were similar proportions of nurses who feel to have caring behavior and ones who feel to have less caring behavior in providing



nursing care to patients. There is a significant relationship between job satisfaction and caring behavior of nurses in the hospital. Nurses with satisfaction with their job were having chance of performing a caring behavior of 5.6 times greater than those who were less satisfied. Job satisfaction is an influential factor on caring behavior of nurse, and every one increase of job satisfaction scores will have an impact on the improvement of caring behavior of nurses.

#### References

1. As'ad, M. (2008). *Psikologi industri*. 4<sup>th</sup> edition. Tenth printing. Yogyakarta: Liberti
2. Burdahyat (2009). *Hubungan budaya organisasi dengan kinerja perawat pelaksana di RSUD Sumedang Tahun 2009*. Unpublished Thesis. Depok: FIK UI
3. Hasibuan, M.S.P. (2009). *Manajemen Sumber daya*. Revised edition. Jakarta: Bumi Aksara
4. Ilyas, Y., (2004). *Perencanaan SDM Rumah Sakit, Teori, Metoda dan Formula*. Jakarta: Pusat Kajian Ekonomi Kesehatan FKM-UI.
5. Juliani (2009). *Hubungan beban kerja dengan caring perawat*. Unpublished Thesis: FIK UI
6. Luthans, F. (2005). *Perilaku organisasi*. Tenth Edition. Yogyakarta: Andi
7. Loundon & Britta. (1988), *Quality improvement in primary care and the importance of patient perceptions*, <http://proquest.umi.com/pqdweb>, date: 10 October 2011.
8. Nurhayati, P. (2007). *Pengaruh gaya kepemimpinan terhadap kepuasan kerja*. Unpublished Thesis. Jakarta: Fakultas Psikologi Universitas Indonesia.
9. Swansburg, R.C. (2000). *Kepemimpinan dan manajemen keperawatan. untuk perawat klinis*, Translated by Suharyati Samba. Jakarta: EGC
10. Sulistiyani, A.T. & Rosidah (2003). *Manajemen sumber daya manusia: konsep, teori dan pengembangan dalam konteks organisasi publik*. Yogyakarta: Graha Ilmu.
11. Suroso, J. (2011) *Survey indeks kepuasan masyarakat Rumah Sakit Islam Purwokerto tahun 2011*. Unpublished Research Report.
12. \_\_\_\_\_ (2011) *Hubungan Kepuasan Kerja dengan Kinerja Perawat Suatu Rumah sakit Negeri di Kabupaten Banyumas*. Surakarta: Jurnal Keperawatan Stikes Aisiyah
13. Tomey, A. M. (1994). *Nursing theorist and their work*, 3<sup>rd</sup> ed. St. Louis: Mosby
14. Watson, J.(1988). *Nursing: human science and human care*. New York: National Language for nursing.
15. \_\_\_\_\_.(2004). *Assessing and measuring caring in nursing and health science*.//books.google.co.id/books?hl=id&client=firefox-a&channel=s&rls=org.mozilla:en-US:official&q=Cronin%20%26%20Harrison%20CBA%20tool&um=1&ie=UTF-8&sa=N&tab=wp, diperoleh tanggal 10 Oktober 2011

## HOW TO INCREASE MILK PRODUCTION FROM MOTHER WITH INFANT LOW BIRTH WEIGHT (LBW)

Umi Solikhah<sup>1</sup>, Indri Wisudawati Anggraeni<sup>2</sup>, Sodikin<sup>3</sup>

<sup>1</sup>Lecturer Faculty of Health Science University of Muhammadiyah Purwokerto

<sup>2</sup>Nurse

<sup>3</sup>Lecturer Faculty of Health Science University of Muhammadiyah Purwokerto

### Abstract

**Background:** Kangaroo care method aims to keep the body temperature stabilization, reducing the risk of infection, increasing the frequency of breastfeeding can have an impact on increasing milk production.

**Objective:** To examine the effectiveness of kangaroo care method to increase milk production in low birth weight infants

**Methods:** This research is a quasi-experimental, with design non equivalent control group and the sampling technique using purposive sampling technique.

**Results:** The mean weight of LBW infants before kangaroo method 1678.42 grams in the intervention group, performed after 1775.00 grams kangaroo method, the results of statistical tests indicate paired t-test p-value 0.000 and the mean weight LBW baby kangaroo that no treatment method before done treatment 1597.24 grams, 1629.61 grams after treatment performed, the results of statistical tests indicate paired t-test p-value 0.001. The mean increase in weight infants in the intervention group was 96.58 grams, in the control group was 32.37 grams. The mean increase in breastfeeding in the control group was 94.13 cc. So every 1 cc of milk production in the control group with 0.34 grams weight gain, so it is expected to increase milk production in the intervention group at 284.06 cc for 5 days. The results of independent statistical tests showed p-value (0.000) < 0.05.

**Conclusion:** Kangaroo care method to increase milk production.

**Keywords:** milk production, low birth weight (LBW)

### BACKGROUND

The main problem in Indonesia is a health problem that occurred of mothers and children, which marked the high maternal mortality rate (MMR) and infant mortality rate (IMR). That's

reflects the ability of the state to provide health services to the public yet either. Low birth weight (LBW) is a major cause of mortality in neonatus.<sup>1</sup>

LBW neonate from January to May (2012) in Margono Soekarjo Purwokerto Hospital, obtained an average of 61 cases with an average of 13 deaths a baby. There are still many cases of LBW and referral is a very fundamental issue that requires special attention related to the proper handling and care.

The success rate is exclusively breastfeeding particularly clearly increased in developed countries, but this has not occurred in developing countries such as Indonesia. Edmond (2006)<sup>3</sup>, revealed when the baby is given the opportunity to suckle within the first hour to let the mother skin to skin contact for at least an hour, it will simplify the process of breastfeeding, and 22% lower the infant mortality rate in under 28 days.<sup>7</sup>

Mothers can successfully breastfeed if the mother is more contact with their baby. Breastfeeding stimulates the production of prolactin, thereby increasing the volume of breast milk and stimulate reflex expenditure. The closest contact occurs when the mother kangaroo method (skin contact directly to the skin baby's mother or surrogate mother). LBW with kangaroo care method, is an excellent means to support the success of exclusive breastfeeding in LBW, because the baby is attached to the mother, the baby will be easier to suck every baby wants it. The key to success is not breastfeeding an infant on the pacifier or bottle<sup>8</sup>.

Kangaroo mother care method closeness between mothers with newborns. Physical contact between the mother and her baby through breastfeeding activity can reduce stress, because the touch of the baby's mother will feel comfortable. When newborns are separated with his mother, the stress hormones will increase to 50%. Increased stress hormones (adrenaline) will cause a decline in the immune system or immune system infant. In the meantime, if done skin contact of mother and baby,

the stress hormones will go back down, so the baby becomes more calm, not stress, as well as respiratory and heart rates more stable<sup>9</sup>.

## METHODE

This study uses a quantitative method to research the type of quasi-experiment. The design of this study used a non-equivalent control group<sup>10</sup>. first treatment group using the kangaroo method, whereas the comparison group without treatment method kangaroo. Sampling is used way that all LBW infants treated that meet the inclusion criteria. Samples were needed in each group totaled 38 respondents in the intervention group and 38 respondents in the control group.

Univariate analysis to describe the characteristics of the respondent (infant birth weight, sex, and gestational age). While bivariate analysis is used to determine whether there is any effect of kangaroo care method to the increase in milk production in LBW infants using independent t-test and to determine the weight gain before and after the study is done using a paired t-test.

## RESULT AND DISCUSSION

### 1. Infant Characteristics

Univariate analysis of this study can be seen in table 1.1 below:

Table 1. Neonatal characteristics:

Variabel	Intervention (n=38)		Control (n=38)	
	n	%	n	%
Age (week)				
a. < 37	26	68,4	31	81,6
b. ≥ 37	12	31,6	7	18,4
Sex				
a. Male	20	52,6	19	50,0
b. Female	18	47,4	19	50,0
Weight Neo (gr)				
a. 1000-1500	8	21,1	14	36,8
b. 1501-2000	30	78,9	24	63,2

### Gestational Age

Most of gestational age on the incidence of low birth weight of less than 37 weeks old both in the intervention and control groups. Gestational age less than 37 weeks in the intervention group 68.4%, gestational age in the control group 81.6%. For gestational age more than or equal to 37 weeks in the intervention

group 31.6%, gestational age in the control group 18.4%.

Graha (2006)<sup>11</sup> showed no significant association between gestational age with LBW, low birth weight can be caused due to premature and dismatur. This suggests intrauterine growth retarded infants. The circumstances associated with impaired circulation and efficiency plasenta<sup>12</sup>.

### Sex

The sex of the baby is not absolutely dominated by a particular sex because the percentage of female sex with men in the intervention group relative to the control group equally. Gender male infants in the intervention group 52.6%, sex baby girl 47.4%, while the boys and girls in the control group 50.0%.

Including the sex of the baby is not one of the factors that influence LBW infants. Based on the results of studies showing that the majority of LBW babies sex men this can be caused by babies who were treated during the study male sex.

### Birth Weight Infants

Infant birth weight between 1000-1500 grams in the intervention group and 21.1% in the control group 36.8%, while the infant birth weight between 1501-2000 grams of 78.9% in the intervention group and the control group, respectively 63.2%.

By definition, low birth weight were divided into 2 groups, namely premature and dismatur. Premature infants whose pregnancies are less than 37 weeks and weight according to weight for gestational age, and dismatur itself is a baby born weighing less than weight for age pregnancy should. Johnston et al (2009)<sup>13</sup> says, infants with birth weights less to get special treatment after birth, special care after birth, for example with the incubator. By using the incubator babies separated from their mothers, this would preclude direct skin contact between mother and baby are very necessary for the growth and development of infants, and if the baby's condition has been stabilized in an incubator can be continued with kangaroo care method.

### 2. Bivariate Analysis

Increased milk production by Baby Weight In Intervention and Control Group.

Table 2. Tabel mean before and after weighing infants ( n = 38/group )

Group	Pre		Post		p value
	Mean	SD	Mean	SD	
Intervention	1678,42	211,207	1775,00	230,59	0,000
Control	1597,24	266,102	1629,61	249,44	0,001

There are still many cases of low birth weight are born either in hospital or referral is a very fundamental issue that requires special attention. It comes to the proper handling and carefully aimed at the case of LBW. Because infants with low birth weight is a risk factor that has contributed to the infant's death, especially in the perinatal period.

Shiau (1997)<sup>14</sup>, the majority of mothers in the developing world is less attention to the handling of infants with low birth weight. Suradi (2000)<sup>7</sup> states, use the incubator to care for low birth weight (LBW) requires a high cost. Due to the limited incubator facility, not infrequently one incubator occupied more than one baby. This increases the risk of occurrence of nosocomial infections in hospitals.

Research of Margaretha (2006)<sup>15</sup> showed that the kangaroo care method is an alternative for the treatment of premature infants. For small premature infants, health care continually is something very important. Treatment with the kangaroo method is an effective way, safe, comfortable and able to meet the basic needs of newborns in the form of warmth, breastfeeding, affection and protection from infection.

#### **Effectiveness kangaroo care method LBW infants to increased milk production**

There are differences in the effectiveness of kangaroo care method to increased milk production in LBW infants.

Table 3. Table weight gain intervention and control groups

Variable	Mean	SD	t	p-value
Intervention	96,58	67,083	4,470	0,000
Control	32,37	57,794	4,470	0,000

Kangaroo method is effective against the increase in milk production are shown in the results of the independent t test with p value of 0.000.

Kangaroo care method is a simple way to increase milk production. Kangaroo care method is ideal for breastfeeding. Mothers can feel when the baby starts hungry mouth movement, suction-small suction and movement baby latch. The method is done by a baby

kangaroo is placed between the second breast in an upright position, the baby's chest attached to the mother's chest, skin to skin contact between the baby and the mother creates a feeling of warm and sweat easily so baby will feel thirsty. In this condition the baby will try to find the mother's nipple and suckling. With the baby sucking at the breast will cause stimulation and if the baby more often disusukan then milk production will increase. Increased milk production can occur with the stronger bond of love the mother and the baby so happens letdown reflex is important for breastfeeding spending. In addition, the stress that usually occurs in mothers whose babies are admitted to the hospital will be reduced if the mother is given the chance would an infant in the kangaroo method, it has a positive effect on milk production<sup>7</sup>.

Nizmawardini and Yaman (1997)<sup>16</sup> provides that during wear kangaroo mother care method to increase breast milk production feel, baby drinking breast milk, body weight and increased infant immune system, perceived kangaroo care method more practical, better growth of infants.

There are significant differences in weight infants receiving kangaroo care method with no kangaroo care method. Kangaroo care method is a way to put the baby in the care of the mother's chest, causing skin contact between the baby and the baby's mother's skin naturally resulting in frequent disusukan. Powered by opinion (Roesli, 2009)<sup>17</sup> which states the more breast milk removed from the breast, the more milk production. The more often breastfeed, the more milk production. Amount of prolactin secreted and the amount of milk produced relating to puff stimulus, namely the frequency, intensity and duration of infant sucking.

Shiau (1997)<sup>14</sup> found that most mothers do not breast-feed attachment correctly. The weakness of the method of breastfeeding can be overcome with the kangaroo method because the baby's nipples with lip contact is strong thus strengthening suction the baby.

Kangaroo care method is a form of influence of a favorable environment for LBW. Efforts to create a stable environment is an

important step to achieve normal development in the future. Psychological reasons stated Agudelo, et al (2011)<sup>18</sup> the kangaroo method will create an inner relationship with the baby's mother is getting stronger so that milk production is much more driven by the feeling of a stronger bond between the baby's mother. This psychological bond causes a more intense pattern of breastfeeding. Hamilton says (1995)<sup>19</sup>, the mother who was anxious to experience the baby blues tend not to breastfeed her baby. One function of the kangaroo method is to strengthen the parent- infant interaction which in turn can reduce maternal anxiety.

#### Comparison of weight infants with breast milk production

Table 1.4. Comparison of mean weight gain of infants with average milk production

Variabel	Intervention	Control	p-v
Weight	96,58	32,37	0,000
Milk mother Production	284,06	94,13	

Weight gain in the intervention group 96.58 grams for 5 days and body weight in the control group 32.37 grams for 5 days. To find out 1 cc of milk production to increase in body weight that is by dividing the mean number of the control group increased weight infants during 5 days (32.37 grams) with a mean milk production during the 5-day control group (94.13 cc) to obtain the results of any 1 cc of milk production in the control group equal to 0.34 grams. To determine the increase in milk production in the intervention group by dividing the mean weight gain intervention group (96.58 cc) with weight gain in each 1 cc of breast milk (0.34 grams). So the expected increase in milk production in the intervention group was 284.06 cc for 5 days. Based on the above results it can be concluded that there is kangaroo method to the increasing influence of milk production. With the results of the independent t-test p value of 0.000.

#### CONCLUSION

Based on the description and discussion of research results can be concluded as follows:

1. Largely gestation less than 37 weeks of either the intervention group or the control group. Sex men in the intervention group were more likely than women, while male gender and women in the control group was relatively similar. Birth

weight between 1501-2000 grams tend to be much more than the weight between 1000-1500 grams.

2. Increased milk production in mothers who received kangaroo care method can be determined by weighing the baby before and after treatment, showed a mean weight gain of LBW babies before the kangaroo care method in the intervention group was 1678.42 grams and the weight after the baby is done kangaroo care method is 1775.00 grams. Statistical test results obtained p-value = 0.000.
3. Increased milk production in women who do not get treatment kangaroo method can be determined by weighing the baby before and after treatment, the mean body weight showed that LBW infants without treatment prior to treatment kangaroo method is 1597.24 grams and weight after baby done treatment is 1629.61 grams. Statistical test results obtained p-value = 0.001.
4. The mean increase in weight infants in the intervention group was 96.58 grams, the control group was 32.37 grams. The mean increase in breastfeeding in the control group was 94.13 cc. So every 1 cc of milk production in the control group equal to 0.34 grams of weight gain, it is estimated that the increase in milk production in the intervention group was 284.06 cc for 5 days. With the results of the independent t-test p - value of 0.000.

#### References

1. World Health Organization. (2009). An epidemiological survey of neonatal sepsis in a hospital in western nigeria. *Journal of Microbiologi Research*,3,(6): 385-389. ISSN 1996-0808.
2. Kemenkes RI. (2010). *Profil kesehatan Indonesia tahun 2009*. Jakarta: Kementerian Kesehatan RI. ISBN 978-602-8937-18-4 351.770212 (Ind P).
3. Edmond, K. M., Zandoh, C., Quigley, M. A., Etego, S. A., Agyei, S. O., & Kirkwood, B. R. (2006). Delayed breastfeeding initiation increases risk of neonatal mortality. *Pediatrics journal* 117: 380-386. doi: 10.1542/peds. 2005-1496.
4. Endyarni, B. (2010). *Indonesia menyusui: Ikatan dokter anak indonesia*. Jakarta: Badan Penerbit IDAI.
5. Roesli, U. (2008). *Inisiasi menyusui dini*. Jakarta: Pustaka Bunda.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

6. Whitelaw, A., Heisterkamp, G., Sleath, K., Acolet, D., & Richards, M. (1988). Skin to skin contact for very low birthweight infants and their mother. *Archives of disease in childhood, department of paediatrics and neonatal medicine*, 63: 1377-1381.
7. Suradi, R. (1992). *Perawatan bergabung di Rumah Sakit Dr. Cipto Mangunkusumo: Air susu ibu tinjauan dari beberapa aspek*. Jakarta: FKUI.
8. Marnoto, W. (2008). *Pemberian asi pada bayi berat lahir rendah*. Jakarta: Perinasia.
9. Prasetyono, D. S. (2009). *Buku pintar asi eksklusif*. Jogjakarta: Diva Press.
10. Notoatmodjo, S. (2010). *Metodologi penelitian kesehatan* edisi revisi. Jakarta: Rineka Cipta.
11. Graha, C. (2006). *Faktor-faktor yang berhubungan dengan kejadian bayi berat badan lahir rendah (BBLR) di Rumah Sakit Urip Sumoharjo Kota Bandar Lampung*. Scription not published. Acces on 29 Agustus 2012.
12. Pantiawati, I. (2010). *Bayi dengan berat badan lahir rendah (BBLR)*. Yogyakarta: Nuha Medika.
13. Johnston, C. C., Filion, F., Yeo, M. C., Goulet, C., Bell, L., Byron, J. (2009). Enhanced kangaroo mother care for heel lance in preterm neonates: a crossover trial. *Journal of Perinatology*, 29: 51-56.
14. Shiau, S. H. H. (1997). Randomized controlled trial of kangaroo care with fullterm infants: Effects on maternal anxiety, breastmilk maturation, breast engorgement, and breastfeeding status. *ProQuest dissertations and theses*
15. Margaretha, S. L. (2006). Metode kanguru pada perawatan bayi berat lahir rendah. *Sari pediatri*, 8 (3): 181-187.
16. Nizmawardini & Yaman. (1997). *Gambaran penerimaan para ibu terhadap metode kanguru di empat Puskesmas Kecamatan Kabupaten Ogan Komering Ulu. Thesis (not published)*. Program Studi Ilmu Kesehatan Masyarakat. Sumatera Selatan.
17. Roesli, U. (2009). *Panduan praktis menyusui*. Jakarta: Pustaka Bunda.
18. Agudelo, A. C., Belizan, J. M., & Rosello, D. J. (2011). Kangaroo mother care to reduce morbidity and mortality in low birthweight infants. *Cochrane database of systematic reviews*. doi : 10.1002/14651858.
19. Hamilton, P. M. (1995). *Dasar-dasar keperawatan maternitas*. Jakarta: EGC.

## **CORRELATION BETWEEN SOCIAL SUPPORT AND POSTPARTUM QUALITY OF LIFE**

**Faizah Betty Rahayuningsih\***

\*Lecturer at *Health Science Faculty, Universitas Muhammadiyah Surakarta*

Email: faizah\_betty@ums.ac.id

### **Abstract**

*The woman adaptation needs social support when the women become the mothers. Home visit is conducted four times as the support from health workers. Government policy is postpartum mothers' and neonatus visit. There is possibility of the assessment of social support and the quality of life when home visit is held, but the assessment of social support and the quality of life for postpartum mothers has been conducted yet. This research design is cross sectional design with longitudinal repeated measure design. This research is aimed to examine the difference and the influence of social support score and also the quality of life postpartum mothers by home visit 1, 2, and 3. The research sample is postpartum mothers. The sample is selected by purposive sampling with the criteria of postpartum mother inclusion that bears a child in pregnancy period > 28 weeks, have contact with grandmother or grandmother-in-law or respected family and living with husband, and want to be the respondent. There is no significant difference of mean between four kinds of support such as husband's, parents', parents-in-law's, and relative's support ( $p > 0,05$ ). Husband's support is significant with the regression equality of life quality of postpartum mothers.*

**Keywords:** *postpartum, quality of life, social support*

### **BACKGROUND**

The social support is important for mother's and child's prosperity. The woman adaptation needs social support when the women become the mothers. There are no life events that have big effect in physical, emotional, and social condition such as postpartum period (Webb *et al.*, 2008). This transition period is often considered as temporary or unimportant thing (Symon *et al.*, 2003) hence the postpartum treatment becomes the ignored aspect for the women's health (Depkes, 2010). Home visit is conducted four times as the support from health workers. Government policy is postpartum mothers' and neonatus visit. There is possibility of the assessment of social support and the quality of

life when home visit is held, but the assessment of social support and the quality of life for postpartum mothers has been conducted yet. This research is aimed to examine the difference and the influence of social support score and also the quality of life postpartum mothers by home visit 1, 2, and 3 in Sukodono subdistrict of Sragen Regency.

### **METHODE**

This research employs cross sectional design with longitudinal repeated measure design. The assessment is conducted three times such as the first assessment (3<sup>rd</sup> to 7<sup>th</sup> day of postpartum), the second assessment (8<sup>th</sup> – 28<sup>th</sup> day of postpartum), and the third assessment (29<sup>th</sup> – 42<sup>nd</sup> of postpartum). The research sample is postpartum mothers from 3 to 40 days. This research is conducted in June to October 2013. The location of this research is conducted in Sukodono subdistrict of Sragen regency. The population of this research is postpartum mothers that give birth in the village of Sukodono subdistrict area. The sample is selected by purposive sampling with the criteria of postpartum mother inclusion that gives birth in pregnancy period > 28 weeks, have contact with grandmother or grandmother-in-law or respected family and living with husband, and want to be the respondent.

Social support of postpartum mothers is self illustration that has interaction with the husband or parents and aimed to fulfill needs to be loved, to be respected, and also to be saved. Thus, the mothers will get happiness that can influence mothers' emotion and behavior. The quality of life of postpartum mothers is the perception of postpartum mothers for their own quality of life. This is measured based on four sub variables of the quality of life by using the quality of life questionnaire Postpartum Quality of Life (PQOL) from Zhou *et al.* (2009). Social support for postpartum mother measure based on 4 sub variables from Hopkins & Campbell (2008). Questionnaire prepared by the researcher. The answer is done by giving score that is appropriate for the perception. The measuring scale with semantic differential scale with answer range between 1= never and 5= really often. The

amount of the score is to see the level of social support of postpartum mothers. The higher score obtained shows the higher social support of postpartum mothers, and vice versa.

The quality of life postpartum mothers uses the instrument such as questionnaire about the postpartum quality of life. The answer is done by giving score that is appropriate for the perception. The measuring scale with semantic differential scale with answer range between 1 = never and 5 = really often. The amount of the score is to see the level of social support of postpartum mothers. The higher score obtained shows the higher social support of postpartum mothers, and vice versa.

Testing the validity and reliability instrument of this research is conducted in June 2013 to 30 research respondents with the sample that is appropriate for inclusion criteria. Validity testing is conducted with correlation testing of Product Moment Person. The question with significant score  $> 0,05$  is tested again with the different sample until the all of question have significant score  $< 0,05$ . Reliability and validity are tested only once, internal consistency testing, by counting the alpha reliability coefficient, by using two-item scale with Spearman-Brown formula for two-item scale (Azwar, 2010). Reliability score instrument has completed  $r \geq 0,30$ , therefore the questionnaire has been reliable to be used in data taken.

The data are collected by numerator by home visit. The assessment is conducted three times such as the first assessment (3<sup>rd</sup> to 7<sup>th</sup> day of postpartum), the second assessment (8<sup>th</sup>–28<sup>th</sup> day of postpartum),

and the third assessment (29<sup>th</sup> – 42<sup>nd</sup> of postpartum). The difficulty and the obstacle are also noted in this research. The possible obstacle is when the mothers are looking after their baby and the only anticipation is waiting till they are free.

## RESULT AND DISCUSSION

### The Characteristic of Respondent

The sample of this research uses 69 postpartum mothers in Sukodono Subdistrict. The analysis result is the average of mothers' age is about 27,94 years old (95%CI:26,63-29,25), median on 27 years old with the deviation standard 5,447 years. For the youngest age is 17 years old, and the oldest ages is 43 years old. The result of estimation interval can be concluded that 95% believed that the mean of mothers' age is between 26,63 – 29,25 years old. Almost distribution job of the respondents is housewife about 40 persons (58%), and there is onl a little amount of farmer that is 2 persons (2,9%). The mothers that work as entrepreneurs are 24 persons (34,8) and civil officers are 3 persons (4,3%). Based on the data above, almost all the mothers are housewives, and then entrepreneur, and then farmer.

Almost distribution education of mothers is junior high school for 34,8% and senior high school for 33,3%. Almost all the education are junior high school, and elementer school 11,6%, Health Diploma Degree 7,2%, Bachelor Degree 5,8%, Senior High School of Health 4,3%, and each for 2,9%.

### The Difference of Social Support at Home Visit 1, 2, and 3 Husband's Support

Table 1. Husband's support at home visit 1, 2, and 3

Variable		Min-Max	Mean	Gain score mean	SD	Gain score SD	SE	t	P-value	N
Husband's Support	K 1	50-94	70.97	1,23	10.21	9,75	1.22	1.04	0,298	69
	K 2	53-96	72.20		9.14		1.10			
	K 2	53-96	72.20	0,69	9.14	8,56	1.10	0.67	0,502	69
	K 3	54-96	71.51		9.16		1.10			
	K 1	50-94	70.97	0,53	10.21	11,54	1.22	0.38	0,701	69
	K 3	54-96	71.51		9.16		1.10			

According to table 1, there is no significant difference between husband's support in measurement K1: K2, K2-K3, and K1-K3, with P-Value score  $> 0,05$ . The increasing of mean score

of husband's support appears in K1:K2, and K1-K3, but there is decreasing of mean score between K2:K3.



### Parents' Support

Table 2. Parents' support at home visit 1, 2, and 3

Variable		Min-Max	Mean	Gain score mean	SD	Gain score SD	SE	t	P-value	N
Parents' Support	K 1	13-60	39.54	0,82	8.76	7,45	1.05	0.921	0.360	69
	K 2	21-61	40.36		7.50		0.90			
	K 2	21-61	40.36	0,66	7.50	5,24	0.90	1.056	0.295	69
	K 3	21-65	41.03		7.69		0.92			
	K 1	13-60	39.54	1,49	8.76	8,99	1.05	1.378	0.173	69
	K 3	21-65	41.03		7.69		0.92			

According to table 2, there is no significant difference between parents' support in measurement K1-K2, K2-K3, and K1-K3, with p-

Value score > 0,05. The increasing of mean score of parents' score appears in all measurement K1: K2, K2-K3, dan K1-K3.

### Parents-in-law's Support

Table 3. Parents-in-law support at home visit 1, 2, and 3

Variable		Min-Max	Mean	Gain score mean	SD	Gain score SD	SE	t	P-value	N
Parents-In-law's Support	K 1	21-54	33.51	0,10	7.43	5.57	0.89	0.151	0,880	69
	K 2	21-56	33.61		7.18		0.86			
	K 2	21-56	33.61	0,92	7.18	5.65	0.86	1.363	0,177	69
	K 3	21-56	34.54		6.52		0.78			
	K 1	21-54	33.51	1,02	7.43	7.10	0.89	1.204	0,230	69
	K 3	21-56	34.54		6.52		0.78			

According to table 3, there is no significant different between parents-in-law's support in measurement K1- K2, K2-K3, and K1-K3, with p-

Value score > 0,05. The increasing of mean score of parents-in-law's support appears in all measurement K1: K2, K2-K3, and K1-K3.

### Relative's Support

Table 4. Relative's support at home visit 1, 2, and 3

Variable		Min-Max	Mean	Gain score mean	SD	Gain score SD	SE	t	P-value	N
Relative's Support	K 1	26-58	38.99	0,33	7.21	5.39	0.86	0.513	0.610	69
	K 2	26-59	39.32		6.46		0.77			
	K 2	26-59	39.32	1,72	6.46	4.88	0.77	2.935	0.005	69
	K 3	23-60	41.04		7.04		0.84			
	K 1	26-58	38.99	2,05	7.21	7.34	0.86	2.328	0.023	69
	K 3	23-60	41.04		7.04		0.84			

According to table 4, there is a significant difference between relative's support in measurement K2-K3, and K1-K3, with p-value score < 0,05, but there is no difference in

measurement K1-K2. The increasing of mean score of relative's score appears in all measurement K1:K2, K2-K3, and K1-K3.

### The Difference of Quality of Life Postpartum Mother at Home Visit 1,2, and 3

Table 5. The quality of life of postpartum mothers at home visit 1,2, and 3

Variable		Min-Max	Mean	Gain score mean	SD	Gain score SD	SE	t	P-value	N
The quality of life postpartum mothers	K 1	102-185	152.30	1,15	18.08	13.61	2,17	0,707	0,482	69
	K 2	107-179	153.46		15.07		1,81			
	K 2	107-179	153.46	0,73	15.07	13,45	2,17	0,456	0,650	69
	K 3	116-182	153.04		15.53		1,87			
	K 1	102-185	152.30	0,42	18.08	10.31	1,81	0,338	0,736	69
	K 3	116-182	153.04		15.53		1,87			

According to table 5, there is no significant difference between the quality of life postpartum mother in measurement K1-K2, K2-K3, and K1-K3, with p-Value score > 0,05. The increasing of

mean score of life quality appears in K1:K2, and K1-K3, but there is decreasing of mean score between K2:K3.

### The Influence of Social Support for Quality of Life Postpartum Mothers

Table 6. The influence of social support for quality of life postpartum mothers

No	Score	Home Visit 1	Home Visit 2	Home Visit 3
1	R <sup>2</sup>	0,157	0,099	0,123
2	B1	0,702	0,370	0,674
3	X1	Husband's support	Husband's support	Parents' support
4	B2		-0,674	-0,633
5	X2		Relative's support	Relative's support
6	P Value	0,001	0,03	0,013

#### Home Visit 1

The analysis by using backward method, in fact the independent variable that includes in

regression model is husband's support. Its equality model is:

$$\text{The quality of life postpartum mothers} = 0,157 + 0,702 * \text{husband's support}$$

Regression coefficient of husband's support is 0,157 states that every additional one score for husband's support, the husband's support will increase the quality of life postpartum mothers around 0,702, in other words the quality of life postpartum mothers will increase up to 0,702 if the mother has husband's support. Significant test score  $t = 0,001$  is in husband's support variable. It means it is below 0,025, therefore the husband's support is

significant, but parent's, parents-in-law's, and relative's support are not significant for the quality of life postpartum mothers.

#### Home Visit 2

After conducted the analysis by using backward method, in fact the independent variable that include in regression model is husband's support and relative's support. Its equality model is:

$$\text{The quality of life postpartum mothers} = 0,099 + 0,370 * \text{husband's support} - 0,674 * \text{relative's support}$$

The quality of life postpartum mothers will increase 0,370 if the mother has husband's support, but it will decrease 0,674 if there is relative's support. The biggest influence of variable is relatives.

#### Home Visit 3

The conclusion of the analysis by using backward method, in fact independent variable that includes in regression model is husband's support and relative's support. Its equality model is

$$\text{The quality of life postpartum mothers} = 0,123 + 0,674 * \text{husband's support} - 0,633 * \text{relative's support}$$

The quality of life postpartum mothers will increase 0,674 if the mother has husband and it will decrease 0,633 if there is relative's support. The biggest influence of variable is husband's support.

### Discussion

The support from family is needed by the women to adapt in transition period to be a parent. Mother or mother-in-law probably will see the depression and low income, thus they can help to solve the problem (Lu *et al.*, 2011). Social support will decrease prenatal depression and will act as savior between potential stressor and care.

Haga *et al.* (2012) identified three aspects of social support that will be used. They are emotional, informational, and instrumental support. There is a relation between postpartum depression with emotional and instrumental support consistently. Depressed women reported that they get less support after they give birth than when they are being pregnant. Postpartum depression event especially is because less emotional support from husband and mother from the women that gets postpartum depression, and also practical help from the husband (Dennis & Ross, 2006), and interaction between mother and father (Lu *et al.*, 2011).

A father will more satisfied if their marriage has the children and they will have more positive attitude as the father, but the satisfaction of marriage has no relation with adaptation of the mother since postpartum period (Lu *et al.*, 2011). Social support has positive influence when the women give birth and it proves as the factor of avoiding postpartum depressi (Evans *et al.*, 2011). Depression is the significant indicator of emotional and instrumental social (Boothe *et al.*, 2011).

Prevalence of postpartum depression is 13,2% for 6 weeks and 9,8% for 12 weeks. Formal structural support and functional emotional support when the mother give birth are the prediction of postpartum independent depression, and for 6 and 12 weeks of postpartum social support dimension that relates with it is social and functional support (Leahy-Warrn *et al.*, 2011).

Postpartum support (Gulick, 2008) consists of: 1) emotional support such as empathy, care, love, and trust. 2) Informational support such as giving the information that can be used to solve the problem like take caring baby, self threatment and personal problems or other environment. 3) Instrumental support such as giving help to take caring baby and do the housework.

Development of the family is important to adapt with the family itself. The proper treatment such as support from the family along for postpartum period can facilitate the adaptation of a mother (Lu *et al.*, 2011). Development of the family and married satisfaction are reported as the adapting factor from mother and father for postpartum period, and expressing love and care to a new mother.

The possible influence of culture and principle should be considered by healthy professional that develops the strategy to facilitate family adaptation with young parents (Lu *et al.*, 2011). Antenatal and postnatal education program are the part of family that is a center of treatment. There is a possibility for the fathers to participate in treatment after the mother give birth.

## CONCLUSION

### Conclusion

Mean of mother's ages is between 26,63 – 29,25 years old. Almost of the education degree of the mothers is junior high school. Based on their job, almost all the mothers are housewives, and then entrepreneur and farmer.

There is no significant difference on mean score for husband's, parents', parents-in-law's, and relative's support ( $p>0,05$ ), but there is significant

difference on relative's support in measurement K2 : K3, and K1 : K3. There is no significant difference on mean score for quality of life postpartum mothers ( $p>0,05$ ).

The regression equality of social support for K1 is the quality of life postpartum mothers =  $0,157 + 0,702 \times \text{husband's support}$ . The equality model of home visit 2 is the quality of life postpartum mother =  $0,099 + 0,370 \times \text{husband's support} - 0,674 \times \text{relative's support}$ . The equality of home visit 3 is the quality of life postpartum mother =  $0,123 + 0,0674 \times \text{husband's support} - 0,633 \times \text{relative's support}$ .

## Recommendation

1. This is suggested to plan education in-service about the important of social support after giving birth for midwife or nurse that has role to service the mothers.
2. This research is to explain about the challenge when giving support that is needed for the mothers to increase their health and to help planning of the program.
3. Giving the education of postpartum preparation is not only for the mothers, but also for their husband.

## References

- Azwar, S. (2010) *Reliabilitas dan Validitas*. Pustaka Pelajar. Yogyakarta.
- Bahadoran, P., Abbasi, F., Yousefi, A. R. & Kargarfard, M. (2007) Evaluating the Effect of Exercise on the Postpartum Quality of Life. *Iranian Journal of Nursing and Midwifery Research Winter* 12(1).
- Bahadoran, P., Azimi, A., Valiyani, M. & Ahmadi, S. A. (2009) The relation between sosial support and postpartum physical health in mothers. *IJNMR*. 14(1).
- Boothe, A. S., Brouwer, R. J., Carter-Edwards, L. & Ostbye, T. (2011) Unmet sosial support for healthy behaviors among overweight and obese postpartum women: results from the Active Mothers Postpartum Study. *J Womens Health (Larchmt)*, 20(11): 1677-85.
- BPS. (2011) *Sragen Dalam Angka Tahun 2011*. Badan Pusat Statistik. Sragen.
- Campbell D.T. & Stanley J.C. (1972) *Experimental and Quasi-Experimental*
- Coyle, S.B., (2011), Maternal concern, sosial support, and health-related quality of life across childhood. *Res Nurs Health*. 2011 Aug;34(4):297-309.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Dennis, C. L. & Ross, L. (2006) Women's perceptions of partner support and conflict in the development of postpartum depressive symptoms. *J Adv Nurs*, 56(6): 588-99.
- Depkes. (2010) *Riset Kesehatan Dasar : Riskesdas 2010*. Jakarta: Badan Penelitian dan Pengembangan Kesehatan Kementerian Kesehatan RI *design for Research*. Rand McNally & Company. Chicago.
- Evans, M., Donelle, L. & Hume-Loveland, L. (2011) Sosial support and online postpartum depression discussion groups: A content analysis. *Patient Educ Couns*.
- Gulick, E. E. (2003) Adaptation of the postpartum support questionnaire for mothers with multiple sclerosis. *Res Nurs Health*. 26(1): 30-9.
- Haga, S. M., Ulleberg, P., Slinning, K., Kraft, P., Steen, T. B. & Staff, A. (2012) A longitudinal study of postpartum depressive symptoms: multilevel growth curve analyses of emotion regulation strategies, breastfeeding self-efficacy, and sosial support. *Arch Womens Ment Health*.
- Hill, P. D., Aldag, J. C., Hekel, B., Riner, G. & Bloomfield, P. (2006) Maternal Postpartum Quality of Life Questionnaire. *J Nurs Meas*, 14(3): 205-20.
- Hopkins, J. & Campbell, S. B. (2008) Development and validation of a scale to assess sosial support in the postpartum period. *Arch Womens Ment Health*. 11(1): 57-65.
- Joan Webster, Catherine Nicholas, Catherine Velacott, Noelle Cridland, Lisa Fawcett, Quality of life and depression following childbirth: impact of sosial support, *Midwifery*, Volume 27, Issue 5, October 2011, Pages 745-749.
- Leahy-Warren, P., McCarthy, G. & Corcoran, P. (2011) Postnatal depression in first-time mothers: prevalence and relationships between functional and structural sosial support at 6 and 12 weeks postpartum. *Arch Psychiatr Nurs*, 25(3): 174-84.
- Lemeshow, S. Hosmer, D.W., Klar, J. & Lwanga, S.K. (1997) *Besar Sampel dalam Penelitian Kesehatan* Yogyakarta: *Gadjah Mada university Press*.
- Lu, Q., Uysal, A. & Teo, I. (2011) Need satisfaction and catastrophizing: explaining the relationship among emotional ambivalence, pain, and depressive symptoms. *J Health Psychol*. 16(5): 819-27.
- Ri-Hua Xie, Guoping He, Diana Koszycki, Mark Walker, Shi Wu Wen, Prenatal Sosial Support, Postnatal Sosial Support, and Postpartum Depression, *Annals of Epidemiology*, Volume 19, Issue 9, September 2009, Pages 637-643
- Sugiyono. (2011) *Metode Penelitian Kuantitatif, Kualitatif, dan R & D*. Penerbit Alfabeta. Bandung
- Symon, A. (2003) A review of mothers' prenatal and postnatal quality of life. *Health Qual Life Outcomes*. 138.
- Webb, D. A., Bloch, J. R., Coyne, J. C., Chung, E. K., Bennett, I. M. & Culhane, J. F. (2008) Postpartum physical symptoms in new mothers: their relationship to functional limitations and emotional well-being. *Birth*. 35(3): 179-87.
- Webster, J., Nicholas, C., Velacott, C., Cridland, N. & Fawcett, L. (2011) Quality of life and depression following childbirth: impact of sosial support. *Midwifery*. 2011 Oct; 27(5):745-9
- WHO. (2008) *WHO Technical consultation on postpartum and postnatal care*. Geneva.
- Wilson, I. B. & Cleary, P. D. (1995) Linking clinical variabels with health-related quality of life. A conceptual model of patient outcomes. *JAMA*. 273(1): 59-65
- Yanita.A.,& Zumralita. (2001) Persepsi perempuan primipara tentang dukungan suami dalam usaha penanggulangi gejala depresi pascasalin. *Phornesis Jurnal ilmiah dan terapan*. Publikasi Fakultas Psikologi universitas Tarumanegara, 3, 23-40. Surabaya Indonesia
- Zainur, R. Z. & Loh, K. Y. (2006) "Postpartum morbidity-what we can do". *Med J Malaysia*. 61(5): 651-6.
- Zhou, S. Z., Wang, X. L. & Wang, Y. (2009) Design of a questionnaire for evaluating the quality of life of postpartum women (PQOL) in China. *Qual Life Res*. 18(4): 497-508.

## CORRELATION BETWEEN KEGEL EXERCISE WITH NEEDLE PERINEUM INJURY HEALING AT NORMAL POSTPARTUM WOMAN IN RB AFIATUN HASANAH BANDUNG

Annisa Ridlayanti  
STIKes Aisyiyah Bandung

### Abstract

Kegel exercise is a pelvic floor exercise which has a purpose to make strengthen pelvic muscle especially pubococcygeal muscle. In postpartum period, kegel exercise can help or speed up the perineum laceration injury healing. Recovery of needle perineum injury is influented by many factors, one of them is blood supply which contains  $O_2$  and nutrient to transfer for injury tissue. Contraction and relaxation which resulted by kegel exercise can increase blood supply to that injury tissue.

Total of perineum hecting on postpartum woman in RB Afiatun Hasanah was 69,91% periode of January to June 2010. Based on medical record, about 43 from 79 patient (54,43%) still felt the pain of needle perineum injury and 'felt' not healing at own perineum injury in sixth days pospartum visit.

This research purpose is to know there is correlation between kegel exercise and needle perineum injury healing in normal postpartum woman. And there is difference needle perineum injury healing in normal postpartum woman who doing kegel exercise and not doing kegel exercise. This riset analysis method uses desain of quasy experimental. Population contained 29 early normal postpartum woman (24 hours) during November 2010. Sample that was taked, early normal postpartum woman with needle perineum injury. For taking sample uses convinience sampling technique. The result, got 24 samples that's divided into two groups. First groups was given kegel exercise and second groups wasn't given kegel exercise. Independent variable is kegel exercise and dependent variable is needle perineum injury healing. To analyse data for correlation and comparison use Pearson and Mann Whitney test.

The result from 24 sample on the 1<sup>st</sup> evaluation got 10 persons at the first groups and 4 persons at second groups who showed the normal perineum appearance. And on the 2<sup>nd</sup> evaluation at the first groups, all sample (12 persons) than at the second groups only 8 persons who showed normal perineum appearance. Pearson test result showed correlation as size as 0,742 with p value is 0,006 and p value < 0,05. This means there was

correlation between kegel exercise and needle perineum injury healing. Comparison analisis test, based on statistic counting was gotten z Mann Whitney value -2,611 with P value is 0,020. Statistic test result showed that P value (0,020) < 0,05, so zero hipotesis was rejected. It could be concluted that there was difference needle perineum injury healing in normal postpartum woman who doing kegel exercise and not doing kegel exercise.

**Keywords:** kegel exercise, needle perineum injury healing, normal postpartum

### INTRODUCTION

In Indonesia, no data about hecting of perineum after childbirth definitely. Wordpress (2010) shows that more than 85% pervaginam delivery with perineum lacerations. It can be spontaneoustly or episiotomi and 70%-80% in that case needs hecting of perineum.

Total of perineum hecting on postpartum woman in RB Afiatun Hasanah was 69,91% periode of January to June 2010. Based on medical record, about 43 from 79 patient (54,43%) still felt the pain of needle perineum injury and 'felt' not healing at own perineum injury in sixth days pospartum visit. It shows that more than 50% patients after hecting perineum still feel uncomfot because of painful in sixth day postpartum period. Of course it needs perineum injury healing care optimally.

Many factors which influent of tissue injury healing. One of them depends on cellular proliferations and syntetic activity because of sensitivity to deficiency local blood supply and patient's nutrient condition.<sup>1,3,4,7</sup>

In normal delivery with perineum lacerations, tissue injury healing without infection usually needs 4-7 days for recovering.<sup>2,4,7</sup>

Kegel exercise can help perineum injury healing in postpartum with make a contraction and relaxation regulary at pubococcygeal muscle. It also can make perineum hecting become well and heal faster. Kegel exercise also can reduce the haemorroid and incontinencia urine. It can reduce

the painful by making the flexibility area. It is very simple and easy to do kegel exercise. It can do anywhere privatly in any positions like sit down, stand-up, and lying.<sup>3,17,18,30</sup>

## METHOD

This riset purpose is to know there is correlation between kegel exercise with needle perineum injury healing in normal postpartum woman. And there is difference needle perineum injury healing in normal postpartum woman who doing kegel exercise and not doing kegel exercise.

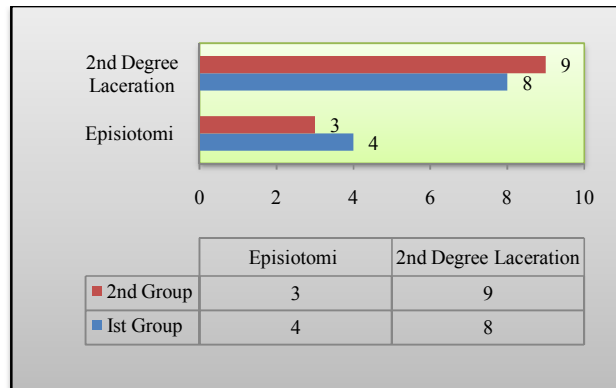
This research method, analysis which use desain of quasy experimental. Population contained 29 early normal postpartum woman (24 hours) during November 2010. Sample that was taked, early normal postpartum woman with needle perineum injury. For taking sample uses non random sampling (convinience sampling) technique. Inclution criterias are postpartum normal, baby's weight about 2500-4000 grams, getting perineum lacerations at least second degree or because of episiotomi, understanding the questions, patients can finish kegel exercise completly, there is an infomed consent. Exclusion criterias are postpartum haemorrhage when research is done and no informed consent or patient denial. The result, got 24 samples that's divided into two groups. First groups was given kegel exercise and second groups wasn't given kegel exercise. Independent variable is kegel exercise and dependent variable is needle perineum injury healing. To analyse data for correlation and comparison use Pearson and Mann Whitney test.

## RESULT

This research is done from 1 November until 15 December 2010. Take place at "Rumah Bersalin Afiatun Hasanah Bandung".

In the first picture shows that kinds of perineum injury. There are laceration and episiotomi. Both of them are second degree perineum rupture.

The first table shows about result of kegel exercise in the treatment group. More than 50% the subject do it completly. The second table tells about normal perineum appearance in twice examinations in 6<sup>th</sup> and 14<sup>th</sup> days. The third table is Output Pearson Correlations Analysis (SPSS). And the fourth table shows that there's a difference perineum appearance between the first group (treatment kegel exercise) and second group (control).



Picture 1. Subject Research Criteria From Kinds Of Perineum Injury

Table.1 Result of Kegle Exercise in First Group

Kegle Exercise	Person	Percentage
Done completly	7	58,33%
Done partly	5	41,67%
Not Done	0	0%
Total	12	100%

Table 2. Perineum Examinations In Normal Postpartum

Normal Perineum Appear	Tampilan Perineum Normal	
	1 <sup>st</sup> Group	2 <sup>nd</sup> Group
6th Day	10	4
14th Day	12	8

Table 3. Output SPSS Correlations Analysis

		Kegle Exercise	Perineum
Kegle Exercise	Person	1	.742**
	Correlation		.006
	Sig.(2-tailed)	12	12
Perineum	Person	12	1
	Correlation		
	Sig.(2-tailed)		12

\*\* . Correlation is significant at the 0.01 level (2-tailed)

Table 4. Mann-Whitney Test

Perineum lacerations Injury Healing	Average	Z	P value	Conclusion	
Treatment	3.83	-2,611	0.020	Ho	Ada
Kontrol	3.00			Ditolak	perbedaan

The result from 24 sample on the 1<sup>st</sup> evaluation got 10 persons at the first groups and 4 persons at second groups who showed the normal perineum appearance. And on the 2<sup>nd</sup> evaluation at the first groups, all sample (12 persons) than at the second groups only 8 persons who showed normal perineum appearance. Pearson test result showed correlation as size as 0,742 with p value is 0,006 and p value < 0,05. It means there was correlation between kegel exercise and needle perineum injury healing. Comparison analysis test, based on statistic counting was gotten z Mann Whitney value -2,611 with P value is 0,020. Statistic test result showed that P value (0,020) < 0,05, so zero hipotesis was rejected. It could be concluded that there was difference needle perineum injury healing in normal postpartum woman who doing kegel exercise and not doing kegel exercise.

## DISCUSSIONS

Based on table.3, Pearson correlation test shows that there's a correlation between kegel exercise with needle perineum injury healing in normal postpartum.

In the first evaluation, about 83,33% (10 from 12 person) in treatment group shows normal perineum appearance which needle close fastly, reduce the painful, no infection although signs of inflamations still be showed from some subjects but it is normal because inflammation process will be felt until 5-7 days. In the second evaluations, all subjects (12 person) shows normal perineum appearance. It is compatible that kegel exercise is not only prevent the incontinetia urine but also help the injury healing because of increasing blood supply to the tissue injury.<sup>1,12</sup>

So kegel exercise is a pelvic floor exercise which has a purpose to make strengthen pelvic muscle especially pubococcygeal muscle. In postpartum period, kegel exercise can help or speed up the perineum laceration injury healing by make the needle closed fastly and reduce the painful of perineum. Contraction and relaxation which resulted by kegel exercise can increase blood supply which contains the O<sub>2</sub> and nutrient to injury tissue recovery.<sup>8,25,30,34</sup>

Based on table 4, Z-Mann Whitney comparrison test shows that there's a difference between needle perineum injury healing in normal postpartum who do kegel exercise and not do kegel exercise. Injury healing process to be seen from clinical perineum appearance.

Perineum appearance in the treatment group shows no opened-needle, no infection signs, no fistula rectovaginalis, and no long great painful at 10 subjects in the first evaluation. And 12 subjects (100%) show normal perineum appearance. It's different with the control group which only 4 subjects in the first and 8 subjects (66,66%) in the second evaluation which show the normal perineum appearance.

Can be concluded that postpartum normal who do kegel exercise procedurally will get needle perineum injury healing fastly.

From that research, every midwives can implementate kegel exercise when their's patients get tears in perineum. Concelling and demonstrate how to do kegel exercise in postpartum period can be given by midwives. Make sure that patients do not be affraid with the hecting of perineum. It's not dangerous, but it can help theirs perineum injury gets healing early and fastly. It also very easy, cheap, advantagable, and privatly. It is not need money to practice as we do an exercise daily. It also can reduce the medical treatment when the postpartum women get normal perineum injury.

It is one of the core midwives competencies which giving a care to the physiologis client naturally not medicinally.

## References

1. Boyle, Maureen. 2008. Pemulihan Luka : Seri Praktik Kebidanan. Jakarta : EGC.
2. Herawati, P. (2010). "Hubungan Perawatan Perineum Dengan Kesembuhan Luka Perineum Pada Ibu Nifas Hari Keenam". Surakarta : Fakultas Kedokteran. Universitas Sebelas Maret.
3. Bahiyatun. 2009. Buku Ajar Asuhan Kebidanan Nifas Normal. Jakarta : EGC.
4. Abraham S, Child A, Ferry J et al. (1990). Recovery after childbirth : a preliminary prospective study. Med J aust. 152 : 9-12.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

5. Brayshaw Eileen. 2007. Senam Hamil & Nifas : Pedoman Praktis Bidan. Jakarta : EGC.
6. BØ K. 1995. Pelvic floor Muscle for the treatment of stress urinary incontinence : an exercise physiology perspective. International Urogynecology Journal 6 : 282-291.
7. Coad, Jane. 2007. Anatomi Dan Fisiologi Untuk Bidan / Jane Coad, Melvyn Dunstall. Jakarta : EGC.
8. Elia G dan Bregman A. (1993). Pelvic Muscle Exercise : When Do They Work ? Obstetr Gynaecol. 81 : 283-6.
9. Errol R. Norwitz dan Jhon O. Schorge. 2008. At a Glance Obstetri Dan Ginekologi. Jakarta : Penerbit Erlangga/ PT. Gelora Aksara Pratama.
10. Fathoni, Abdurrahmat. 2006. Metodologi Penelitian Dan Teknik Penyusunan Skripsi. Jakarta : PT Rineka Cipta.
11. Fleeming V, Hagen S dan Niven C (2003). Does Perineal Suturing Make A Difference ? The SUNS Trial. Br J Obstet Gynaecol. 110 : 684-9.
12. Glazener C, Herbison G, Wilson P et al. (2001). Conservative Management Of Persistent Postnatal Urinary And Faecal Incontinence : A Randomised Controlled Trial. BMJ. 323 : 593-6.
13. Hay-Smith E. J. Bo Berghams L. C, Hendrics H. J. Et al (2001). Pelvic floor muscle training for urinary incontinence in women. Cochrane Database Systemic Revue (1) : CD001407.
14. Head M (1993). Non-Suturing Of Tears To The Perineum. In : Proceedings of the International Confederation of Midwifery, 23rd International Congress, Vancouver, Canada : 809-22. 9-14 May 1993.
15. Hidayat, Aziz Alimul. 2007. Metode Penelitian Kebidanan Dan Teknik Analisis Data. Jakarta : Salemba Medika.
16. Indiarti, M.T. 2008. Senam Hamil & Balita. Yogyakarta. Cemerlang Publishing.
17. International Continence Society (2002). The Standardisation of Terminology in Lower Urinary Tract Function : Report From The Standardisation Sub-committee of the International Continence Society.
18. Jolley J. V. 1990. The reported prevalence of urinary symptoms in women in one rural practice. British Journal Of General Practice 40 : 335-337.
19. Jones, D Llewellyn. 2001. Dasar-Dasar Obstetri Dan Ginekologi Ed. 6. Jakarta : Hipokrates, pp 56-79.
20. Kumala, Poppy et.al. 2005. Kamus Saku Kedokteran Dorland Ed. 25. Jakarta : EGC.
21. Lewis G (ed.) (2004). Why Mothers Die : Confidential Enquiries Into Maternal Deaths In The UK : 2000-2002. RCOG Press, London.
22. Maryunani, Anik. 2009. Asuhan Pada Ibu Dalam Masa Nifas (POSTPARTUM). Jakarta : CV. Trans Info Media.
23. Morgan, Geri dan Carole Hamilton. 2009. Obstetri & Ginekologi : Panduan Praktik / geri Morgan, Carole Hamilton Ed. 2. Jakarta : EGC. 2009.
24. Morkved S, Bo K, 1997. The effect of postpartum pelvic floor exercise in the prevention and treatment of urinary incontinence. International Urogynecology Journal 8 : 217-222.
25. Morkved S, Bo K, 2000. Effect of postpartum pelvic floor muscle training in prevention and treatment of urinary incontinence : a one-year follow up. British Journal Of Obstetrics & Gynaecology 107 : 1022-1028.
26. Murkhoff, et.al. 2007. Mengatasi Trauma Pascapersalinan. Jawa Tengah. Image Press.
27. Nursalam. (2008). Konsep Dan Penerapan Metodologi Penelitian Ilmu Keperawatan Ed.2 Pedoman Skripsi, Tesis, dan Instrumen Penelitian Keperawatan. Jakarta : Salemba Medika. Prawirohardjo, Sarwono. 2009. Ilmu Kebidanan. Jakarta : YBPSP.
28. Saifuddin, Abdul Bari, dkk. 2004. Buku Panduan Praktis Pelayanan Kesehatan Maternal Dan Neonatal Ed.1. Jakarta : Yayasan Bina Pustaka Sarwono Prawirohardjo.
29. Simkin Penny, Janet Whalley, Ann Keppler. 2007. Kehamilan, Melahirkan, & Bayi : Panduan Lengkap. Jakarta : Arcan.
30. Sleep, J Dan Grant A. (1987). Pelvic Floor Exercise In Postnatal Care. Midwifery 3 : 158-64.
31. Sudjatmiko, Gentut. 2009. Menjahit Luka. Jakarta : CV Sagung Seto.
32. Sugiono. 2007. Statistika Untuk Penelitian. Bandung : CV Alfabeta.
33. Suyanto dan Umami Salamah. 2008. Riset Kebidanan. Jogjakarta : Mitra Cendikia Press.
34. Taskin, Omur, dkk. (1996). The Effects Of Episiotomy And Kegel Exercises On Postpartum Pelvic Relaxation : A Prospective Controlled Study. Journal Of Gynecologic Surgery. Summer, 12 (2) : 123-127.
35. Thakar R, Stanton S. 2002. Management of genital prolapse. British Medical Journal 324 (7348) : 1258-1262.



**THE CORRELATION BETWEEN SELF-CONFIDENCE AND  
DEPRESSION LEVEL OF TEENAGE ORPHANAGES  
IN PANTI ASUHAN YAYASAN SATU UMAT IN MAGELANG**

**Peni Nurman<sup>1</sup>, Sambodo Sriadi Pinilih<sup>2</sup>, Priyo<sup>3</sup>**

Nursing Science Department of Health Science Faculty of Muhammadiyah University of  
Magelang

Email: fazakupinilih@gmail.com

**Abstract**

*Psychological burden, such as inferior, passive, apathetic, introvert, pessimistic, fearful, and anxious personality that happens to teenagers in orphan house can make them difficult in making social interaction with others. This situation leads to self-confidence lost. This study aims to find out the correlation between self-confidence and depression level of teenaged orphanages. The research method uses cross sectional approach to 105 teenagers as the sample. The result of the research shows that there are correlation amongst age, self-confidence, and depression of the teenage orphanages.*

**Keywords:** *self-confidence, depression, teenage orphanage*

**BACKGROUND**

Adolescence is also called as storm and stress phase, a situation that is full of problems, demands, and life stresses. Therefore, as people on the age level of important roles in the nation development productivity, adolescents or teenagers need to be prepared and their condition has to be kept healthy both physically and mentally. One of the environments that plays role in the teenagers development and which is ready to face their development tasks, is family. It would be different with teenagers who live in orphan house, as the role of family has been replaced (Napitupulu, 2007).

Psychological burden, such as inferior, passive, apathetic, introvert, pessimistic, fearful, and anxious personality that happens to teenage orphanage can make them difficult in making social interaction with others. This situation leads to self-confidence lost. The lives of teenagers in orphan house are not free from problems and difficulties so that they have to avoid depression.

Teenager and adult are the age groups that suffer depression the most. It happens as in those age there are important phases and development tasks that is the transformation from childhood to

teenage, teenage to adult, school to college or work, or puberty to marriage. Age factor is included to physical factor that can affect depression factors (Lumongga, 2009).

The depression occurs in a teenager can be very dangerous as it causes the difficulty in concentrating or the decrease of memory, discouragement, the loss of fun and interest, that can decrease the teenage productivity and affect the school achievement (Yosep, 2007). Unsolved depression on teenagers can disturb their ability in doing activities effectively which then negatively affects their physical and psychological health, and their wealth. The symptoms of depression can be decreased by self confidence, as self-confidence is a belief in the abilities owned, belief in the intent or purpose in life, and belief in the intellectuality are able to carry out what is wanted, planned, and hoped (Davies, 2004). Orphanages are population which is prone to depression, because they were apart from the most important figure, parents, so that they get less affection (Rusanto, 2007).

**RESEARCH METHOD**

This research was descriptive correlation with cross sectional approach which was done in July 2013. The sample taking technique was purposive sampling. The research was obtain to find out whether there were any correlations between self-confidence and depression level on teenagers in orphanage.

The sample of this research was 105 teenagers. Statistic analysis used was univariate and bivariate with Spearman Rank Correlation Test (Rho) analysis and multivariate analysis used Logistic Regression.

**RESULT AND DISCUSSION**

Confounding variables in this research were including age, sex, and the length living in the orphanage. The most orphanages were female (61,9%), average age were 16-20 years-old

(55,2%), and average length of stay in the orphan house was 1 year (53,3%).

The result of teenagers' self-confidence measurement showed that 62.9% were in medium category, 31.4% were in low category, and 5.7% were in high category. Teenaged orphanages with depression level in mild category were 46.7%, and 1.9% were in weight category.

Based on the analysis of the correlation between sex and depression level, the result showed that female teenagers experienced mild depression (28.6%), while male teenagers (18.1). Percentage of depression on female teenagers was bigger than on male teenagers because the number of female teenagers was bigger than the number of male teenagers. The coefficient correlation value, based on Spearman Rank data analysis was 0.316 which meant the correlation between sex and depression level was small.

The most significant difference between depression on male and female was on the frequency, so that as the result the research on depression and gender has historically focused on why women are more susceptible to stress or depression. In this research sex did not affect depression on teenaged orphanages in Yayasan Satu Umat Orphan House. It was possibly caused by the number of female orphanages were bigger than male orphanages.

Correlation between teenage orphanages' characteristics based on age and depression level showed that teenage orphanages aged 16-20 experienced mild depression the most (26.7%) Teenagers aged >20 years old experienced medium-weight depression 1.0%. Coefficient correlation values based on Spearman Rank test analysis was 0.267 which is small (not close).

The above finding was probably because the teenage orphanages have not realized or recognized some symptoms that led to depression. According to Blackman (in Lubis, 2009), most depression in teenagers are not diagnosed until they find serious difficulties in school and self adaptation which often continue in adulthood.

The analysis result on the correlation between the length of stay and depression level on teenage orphanages showed that most of orphanage that experienced mild depression was 26.7% who lived in the orphan house for 0-1 years. Coefficient correlation values based on the result of Spearman Rank analysis was 0.044 which was very small.

One of the efforts of the teenage orphanages to overcome the experienced changes from the previous home environment to orphanage environment is by coping mechanism. It is

supported by Ahyar's (2010) opinion that if the coping mechanism can be applied well, someone can adapt with the changes or burden (Ahyar, 2010) Coping mechanism done by teenage orphanage is the effort to cope with changes or burden accepted by body and the burden can cause nonspecific body response that is stress or depression.

The analysis result used to find out whether there was a correlation between self-confidence and depression level by comparing correlation value with alpha 5% (0.05), it obtained r value 0.358 with significance value 0,000 less than 0.05. Coefficient correlation had value as big as -0.358 which meant the correlation was small. Significance value  $0.000 < 0.05$  so that it can be concluded that there was a significant correlation between self-confidence and depression level.

From the bivariate analysis result, there were 3 variables that will be continued to multivariate analysis (p value < 0.25), they were self-confidence, sexes, and age. The variables were then analyzed by using logistic regression simultaneously. The variable included in multivariate analysis is variable with p value < 0.25 (Dahlan, 2012) The researcher performed logistic regression analysis because the data to be processed is categorical data

The multivariate analysis result showed that self-confidence, sex, and age had correlation with and role in teenage orphanages' depression. OR with value more than 1 ( $OR > 1$ ) meant that the correlation was significant. Age variable had the most significant correlation that affected the orphanages depression as the obtained p value =  $0.029 < 0.05$  and had OR value = 3.09 (IK 95%, 1.21-8.51), it means that age had possibility 3.09 times more affected depression compared with self-confidence with p value = 0.951; OR = 1.06 (IK 95% 0.18-6.24) and sex with p value 0.117; OR = 2.29 (IK 95% 0.81-6.45).

Orphanages are population which is prone to depression, because they were apart from the most important figure, parents, so that they get less affection (Rusanto, 2007). One of the environments that plays role in the teenagers development and which is ready to face their development tasks, is family. It would be different with teenagers who live in orphan house, as the role of family has been replaced (Napitupulu, 2007)

## CONCLUSION

The characteristics of teenage orphanages in Panti Asuhan Yayasan Satu Umat Magelang are, from 105 people mostly are female, aged range from 16 to 20, and have lived in orphan house for less than 1 year. Teenage orphanages' self-

confidence levels were mostly in medium category as many as 66 people (62%). Depression levels of teenagers in Panti Asuhan Yayasan Satu Umat orphan house were mostly mild depression, as many as 64 people (61%).

From the analysis result, it was figured out that there was correlation between self-confidence and depression. Age was the variable with tightest correlation with depression on teenage orphanages in Yayasan Satu Umat orphan house.

#### Reference

- Ahyar. (2010). *Konsep diri dan mekanisme coping* diambil tanggal 25 Agustus 2013 dari [http://www.konsepdiridanmekanisme\\_coping\\_dalam\\_aplikasi\\_proses\\_keperawatan.htm](http://www.konsepdiridanmekanisme_coping_dalam_aplikasi_proses_keperawatan.htm).
- Dahlan, M. Sopiudin. (2012). *Statistik untuk Kedokteran dan Kesehatan; Deskriptif, Bivariat, dan Multivariat Dilengkapi Aplikasi dengan Menggunakan SPSS*. Rawangmangun: Salemba Medika.
- Davies, P. (2004). *Meningkatkan Rasa Percaya Diri*. Alih Bahasa Saut Pasaribu. Yogyakarta: Torent Books. Dewi, P. E. 2004.
- Lumonga, N., (2009). *Depresi Tinjauan Psikologis*. Jakarta : Kencana.
- Napitupulu, Paiman. (2007). *Pelayanan Publik & Customer Satisfaction*, Bandung: P.T. Alumni.
- Yosep, I. (2007). *Keperawatan Jiwa. (edisi 1)*. Bandung : Refika Aditama.

**DETERMINATION AND VALIDATION METHOD OF TOTAL FLAVONOID  
CONTENT AND TOTAL PHENOLIC CONTENT OF ETHANOLIC EXTRACT OF  
MANGOSTEEN (*Garcinia mangostana* L.) LEAVES AS NATURAL  
PRESERVATIVES CANDIDATE BY USING SPECTROPHOTOMETRIC METHOD**

**\*Diniatik, Indri Hapsari, Milani Tiara, Ayu Meidyawati, Suhri Nurhidayat**  
Faculty of PharmacyFakultas Farmasi Muhammadiyah Univercity of Purwokerto  
Jalan Raya Dukuhwakuh PO BOX 202, Purwokerto 53182, Jawa Tengah, Indonesia  
\*E-mail: diniatik@yahoo.com.au

**Abstract**

*Mangosteen has great potential as a natural preservative, it is necessary to ensure the content of compounds that have the potential levels. This study aimed to determine levels of total flavonoid content and total phenolic content and the validation methods. Determination and validation method used spectrophotometric methods, the methods of hydrolysis on total flavonoid content and the folin ciocalteu reagent method in the determination of phenolic total. Spectrophotometric method can be used for the determination of total flavonoid content with the results of the validation are eligible. The result of determination of total flavonoid content in 50% ethanol extract was  $26.80 \pm 15.9\%$ . Spectrophotometric method can be used for the determination of total phenolic content with the results of the validation are eligible. The result of determination of total phenolic content in 50% ethanol extract was  $71.94 \pm 12.37\%$ .*

**Keywords:** *ethanolic extract of *Garcinia mangostana* leaves, spectrophotometri, total flavonoid content, total phenolic content*

**INTRODUCTION**

Currently the plant has many uses by humans, as building materials, food, medicine. The utilization of plants as additional material is limited, natural dyes, natural flavoring, natural smell giver, but as a natural preservative is limited utilization. Natural preservatives from plant could be developed further because of the danger of side effects and limitations of synthetic preservatives when used in large quantities is not good effect. The use of plants as a natural preservative has economic potential, as more people aware the dangers of synthetic preservatives so that people interested in eating organic food and organic processed food.

In processed foods, brown sugar, sodium metabisulfite used as a preservative, which has

some potentially damaging effects of such toxic genes (mutagens) terhadap bacteria have a tendency toward carcinogens, long-term use produces damaging organs (skin allergy, liver, metabolism and urinary system, asthma), toxic to the respiratory tract, skin, eyes, reproductive organs. Toxicity in rat LD50 1131 mg / kg and guinea pig skin LD50> 1000mg/kg. This spurred the possibility that relatively safer preservatives, with long-term continuity of production.

Mangosteen has informed empirically used as a preservative, especially the skin of the fruit. Thus the excavation of the main part of the leaves of this plant which is part of the easy and cheap to produce natural preservative be more likely to meet the needs of sustainable natural preservative. In the research that has been done further examine the skin of the fruit, but the research that has been done by Diniatik and Supaman (2011) reported the antioxidant activity of the leaves better than the skin of the fruit. Continued research and Diniatik Supaman (2011), reported the antibacterial activity was also the leaves better than the skin of the fruit. The first phase of the study showed antioxidant activity, antifungal and antibacterial of 50% ethanol extract of mangosteen leaves have the best potential. So it is very interesting to do further research to the second and third stages. There are three problems of this resears:

1. How validation method and determination total flavonoid content in the ethanol extract of mangosteen leaves?
2. How validation method and determination total phenol content in the ethanol extract of mangosteen leaves?
3. How determination methods xanthone content in ethanol extract of mangosteen leaves?

**METHOD**

**Variables in The Research**

The definition of operational variables in this study include independent variables used were 50%

ethanol extract. Dependent variable is the level of flavonoids, phenols and total ethanol extract of leaves xanthon *G. mangostana* L. And the control variable is validated assay method with spectrophotometric method.

### Sample and Standard

The sample was used in this study is the ethanol extract of leaves of *G. mangostana* L. standard rutin, gallic acid and alpha mangosteen.

### The Way of The Research

#### 1. Plant Determination

Mangosteen (*G. mangostana*) were used in the research determined in the Laboratory of Biology, Faculty of Education Studies Teacher Training and Education, University of Muhammadiyah Purwokerto. The results of determination convey that the plant specimen is *Garcinia mangostana* L. plant of the family Clusiaceae. The results of the determination by the book Flora of Java Vol II (Backer & Van Den Brink, 1965).

#### 2. Collection of materials

Crude leaf *G. mangostana* Leaves of *G. mangostana* were taken Banyumas regency, Central Java. Drying is done by putting materials that have been washed clean in the winnowing, then covered with a black cloth that is not exposed to direct sunlight. After it dried under the sun to dry. The dried crude drug (taking into account the requirements of the maximum water content in crude drug) diserbuk and placed in a brown bottle dry.

Materials used in this study:

Ethanol, ethyl acetate, distilled water, acetone, methanol pa., several standards that rutin, gallic acid and alpha mangosteen.

The equipments were used in this study:

Maceration equipment, Bekker Glass (Pyrex) glass and other tools, Rotary Evaporator, electric cooker, separating funnel, UV spectrophotometer, micropipette, filter paper.

#### 3. Preparation of ethanol extract of leaves of *G. mangostana* L.

Crude leaf weighed +3 kg powder made by grinding and sieving process. +750 grams of dry powder was weighed and then macerated. Maceration is done by immersing the crude drug powder in the solvent. In this research, to improve the effectiveness of the extraction is done stirring and remaceration, macerated for 2 x 24 hours with a comparison between the crude drug with 50% ethanol is 1:5 for the first day, and 1:4 for the second day. The way is as much as 750 grams of powder botanicals are macerated with ethanol 50%

as much as 7.5 liters, then precipitated, poured and squeezed. Dregs obtained macerated again with as much as 3 liters of ethanol.

Extracts of juice were made by using fresh leaves that have been washed and then 3 kg of leaves blended with 3 liters of distilled water until soft portion. Filtered with a flannel cloth.

Extracts of juice and ethanol were evaporated to a thick consistency is obtained which still can be cast and then be weighed. Preparation of ethanol extract of leaves of *G. mangostana* done at the Laboratory of Pharmaceutical Biology, Muhammadiyah University of Purwokerto.

#### 4. Determination of total flavonoid content and validation method

The principle of this method is that the levels are defined as flavonoid aglycone by hydrolysis method, spectrophotometric measurement at a wavelength of maximum, after reacted with  $AlCl_3$  to improve selectivity and added heksanametilentetramin.

The workings of hydrolysis is as follows: 100 mg of extract was weighed precisely and put in a round bottom flask. Added hydrolysis system, ie 1.0 ml solution of 0.5% w/v heksanametilentetramin, 20.0 ml of acetone and 2.0 ml of HCl (25%) in water. Do hydrolysis by heating to boiling (used cooling water or reflux) for 30 minutes. Hydrolysis resulting mixture was filtered using a cotton swab into a 50.0 mL volumetric flask. Hydrolysis residue plus 10 ml of acetone to boil again briefly, do as much as 2 times and the filtrate collected all into the flask. After a cold flask, then the volume is turned up just 50.0 ml, beaten flat. Hydrolysis filtrate was extracted by 20 ml whipped with a separating funnel, first with 10 ml of ethylacetate. Then 2 times with 5 ml of ethyl acetate, and the ethyl acetate fraction was collected into a 25.0 mL volumetric flask, until it finally added 25.0 ml of ethyl acetate (POM, 2000). Validation of a method to determine the linearity, LOD (Limit of Detection) and LOQ (Limit of Quantification).

#### 5. Determination of total phenolic content and validation method

Total phenol content in the 50% ethanol extract of mangosteen leaves. Weighed 0.3 grams of extract were diluted to 10 ml denganmetanol: water (1:1). Pipetted 0.2 ml of extract solution and tambahkan15, 8 ml aquabidest add 1 ml of reagent Folin-Ciocalteu shake. Let stand for 8 minutes then add 3 ml of 20%  $Na_2CO_3$  into the mix, let stand solution for 2 hours at room temperature. Measure with spektrofotometeriUV-Vis absorbance at 765 nm maximum absorption panjanggelombang which

will provide complex biru. Lakukan 3 times repetition so that diperoleh hasilnya phenol obtained as mg gallic acid equivalent/g fresh sample (Scrambled, 2006). Validation of a method to determine the linearity, LOD and LOQ.

#### 6. Analysis

Datas were obtained from measurements using a standard curve of linear regression equation on the relationship curve between the absorbance of the extract concentration (Gulluce, et al., 2006).

### RESULT AND DISCUSSION

#### Plant Determination

Mangosteen (*G. mangostana*) were used in the study determined in the Laboratory of Pharmaceutical Sciences Faculty of Pharmacy, Muhammadiyah University of Purwokerto. The purpose of determination to get the truth with a clear identity of the studied plants and avoid mistakes in the collection of primary research materials. The results of determination stating that the plant specimen is really-really plant *Garcinia mangostana* L. of the family Clusiaceae. The results of the determination by the book Flora of Java Vol II (Backer and Van Den Brink, 1965).

#### Materials Collection and Crude Preparation of Leaves mangosteen (*G. mangostana*)

In this study the use of mangosteen (Figure 1) were taken at the District Somagede, Banyumas. Fresh leaves of mangosteen taken in May in the morning. The leaves are plucked fresh mangosteen leaves was being taken from the 30-year-old trees since planting, the leaves taken after post-harvest fruit. The leaves are taken is elderly, because it is expected that the chemical content obtained were optimal (Anonymous, 1985). Decision were done at a certain time and place to avoid wide-range of chemical constituents due to differences in environmental conditions, objec soil, and climate.



Figure 1. Mangosteen plant (*G. mangostana*)

Fresh mangosteen leaves were obtained, washed with running water to remove any dirt or

contaminants in the form of soil, or other materials on the the leaves. Selected the leaves (15 kg) is good for the next aerated. Partially dried mangosteen the leaves in the sun covered with black cloth, for the purpose of extraction with ethanol. During heating, the material is not accumulated and inverted laid-back that evenly heating and drying process takes place quickly. The dried mangosteen leaves on the seventh day. Leaves the rest was made in the form of mangosteen juice (Anonymous, 1985). Drying is done until the moisture content is less than 10% or until the leaves are easy to be destroyed when squeezed. The purpose of drying is to prevent the growth of fungi or microorganisms and the decomposition of active compounds by enzymatic reactions and hydrolysis process because of high water content, so that the resulting crude drug is not easily damaged so it can be stored in a relatively long time. Dried Simplicia were grinded then by using a blender to minimize the surface area that contacts the surface of the particles of crude drugs with greater solvent and dissolving more optimal.

Crude further were sieved using a sieve mesh 20/40 which means as much as 100% dry simplicia passes on 20 mesh sieve, then as much as 40% from 100% dry simplicia 40 mesh sieve, so that 500 grams of dried botanicals mangosteen the leaves and bark as much as 300 grams 20 mesh sieve and sieve as much as 40 grams of 200. In general screening process is important in the extraction process, due to the presence of particle size reduction will expand the contact surface with the powder so penyari maximum and extraction becomes more active substances may be taken optimally.

#### Making Ethanol Extract of Mangosteen Leaf

Dissolution method used is maceration. This method is the simplest method because it is easy to do, inexpensive, does not require sophisticated equipment. Maceration is done by soaking the powder in a liquid botanicals penyari. In this research, to improve the effectiveness of the extraction is done stirring and remaserasi, macerated for 2 x 24 hours with a comparison between the crude drug with 50% ethanol is 1:5 for the first day, and 1:4 for the second day. The trick is as much as 750 grams of powder botanicals are macerated with ethanol 50% as much as 3.75 liters, then dienap-pour and squeezed. Dregs obtained again macerated with ethanol 50% as much as 3 liters.

In this study, the solven were used 50% ethanol. Solven 50% ethanol can be interesting compound - a relatively polar compounds such as

phenolic compounds, flavonoids, saponins, and other polar compounds contained in mangosteen the leaves, whereas ethanol is ethanol used in the market is technically possible it is recovered when evaporated with a rotary evaporator. Ethanol is more selective, non-toxic, neutral, good absorption,

can prevent the growth of mold and bacteria, the heat required for concentration less. Juice obtained is evaporated over a water bath until a thick consistency. Evaporation is done to eliminate solven solution so as not to affect the next examination as shown in Table 1 below.

Tabel 1. The yield of ethanol extract

Type	The weight of wet simplicia	The weight of dry simplicia	Extract weight	Rendemen
ethanol extract 50%	3 kg	750 g	175,41 g	5,647%

#### Method Validation and Determination of Total Flavonoids Content

Total flavonoid content of ethanolic leaf extract of mangosteen determined using spectrophotometric methods that have been recommended in the book POM body Sandar Extract Parameters (Anonymous, 2000). The principle of this method is that the levels are defined as flavonoid aglycone by first hydrolyzed and subsequent spectrophotometric measurements by reacting  $\text{AlCl}_3$  occurs that causes a wavelength shift to the right, making it more selective. Hydrolysis (reflux) done to change into aglycone flavonoid glycosides flavonoids and glikon. This is done because the flavonoids in ethanolic herbal extracts contained in china patikan glycoside and aglycone form. Determination of total flavonoid levels aims to establish the levels of all flavonoids (total), with hydrolyzed, all will flavonoid aglycone

flavonoids tertetapkan as advantageous because it derived flavonoid levels is certainly more appropriate. Wavelength shift toward longer bathochromic well as OH groups that had been closed off so that the sugar will slide more reactants to form bonds, the maximum wavelength becomes larger, making it more selective. The disadvantage is the long working procedures so that the possibility of error for greater progress, for it is the determination of the total flavonoid content patikan chinese herbs to prior validation of methods including linearity, precision, accuracy, detection limit of the test.

The standard used was rutin, quercetin and ramnoglukosa hydrolyzed form. After the quercetin was added  $\text{AlCl}_3$  reagent to form a chelate complex that become has a larger maximum wavelength (figure 2).

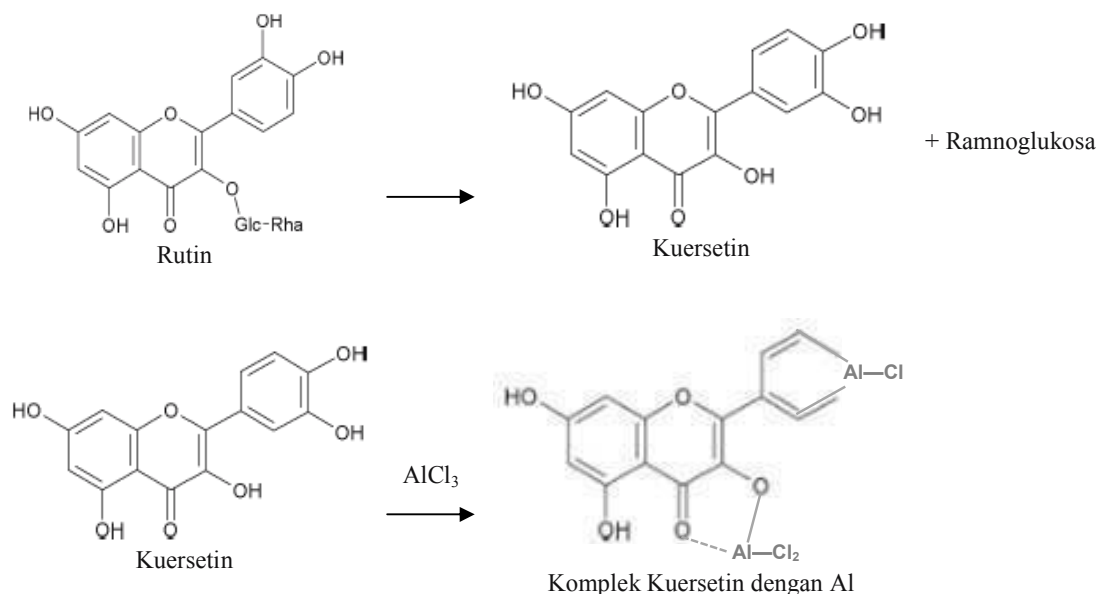


Figure 2. Hydrolysis rutin into quercetin and reaction with  $\text{AlCl}_3$

## 1. Preparation of Standard Curve and Linearity

Standard curve was obtained by varying the levels that have been hydrolyzed rutin (same method with the sample) was measured at a wavelength of 417 nm maximum. From the data obtained by spectrophotometric absorbance for each concentration (Table 2). The absorbance is plotted with each concentration to make the linear regression equation  $y = bx + a$ . From the

relationship curve between absorbance and concentration will be obtained correlation coefficient ( $r$ ) as a parameter to determine linearity. The results obtained equation has good linearity, because  $r$  count (0.9984) is greater than  $r$  table (0.811, for  $N = 6$ , 95% confidence level) (Hadi, 1996). Standard curve was obtained  $Y = 0.00491x - 0.00726$  is used to determine the total flavonoids content, linear regression curve can be seen in Figure 3.

Table 2. Absorbance and standard curve

No.	Rutin content(mg/L)	Absorbance (A)	The result of linear regression
1.	40	0,1938	$r = 0,9984$ $a = -0,00726$ $b = 0,00491$
2.	80	0,3878	
3.	120	0,5515	
4.	160	0,8114	
5.	200	0,9790	
6.	240	1,1642	



Figure 3. Standard linear regression curve of rutin that has been hydrolyzed

## 2. Determination of Limit of Detection

To determine the total flavonoid content in the sample was able to be detected by this method was measured the levels of several standard rutins that have been hydrolyzed. The measurement results can be seen in table 3. Limit concentration of standard solutions that can still be detected by spectrophotometric method is 1.25 mg/L. This

means that the total flavonoid assay with a standard rutin which is hydrolyzed to the sample by spectrophotometric methods measure should be greater than 1.25 mg/L. Figure 4 shows the linear regression curves were created from data from the determination of the minimum limit of detection with a correlation coefficient of  $r = 0.9979$ .

Table 3. Absorbance data and results of the minimum limit of detection

No.	Rutin content (mg/L)	Absorbance	Results of the minimum limit of detection
1.	20	0,0933	$r = 0,9979$ $a = -0,001939$ $b = 0,004736$
2.	10	0,0436	
3.	5	0,0249	
4.	2,5	0,0065	
5.	1,25	0,0027	
6.	0,06	-0,0011	





Figure 4. Linear regression curve assay

### 3. Determination of Precision

Precision test is done by making six replication of a standard rutin that has been hydrolyzed. The absorbance obtained standard curve were plotted on the  $Y = 0.00491x - 0.00726$  to obtain calculated content, and then calculated the

average concentration, standard deviation and coefficient of variation (Table 4). The coefficient of variation (CV) was 1.80%, less than 5% indicates that this method has a good precision (Peter & Richard, 2000).

Table 4. Absorbance data and the results of precision test

No.	Absorbance	Rutin Content (mg/L)	The results of precision test
1.	0,5619	115,91	Rata-rata = 113,87 SD = 2,05 CV = 1,80%
2.	0,5508	113,65	
3.	0,5482	113,12	
4.	0,5649	116,52	
5.	0,5374	110,92	
6.	0,5482	113,12	

### 4. Accuracy

Test of accuracy (closeness) is done by calculating the recovery rutin standard that has been hydrolyzed. Recovery percentage was calculated by making a comparison between content from the results of analysis with actual content. The absorbance were obtained, were plotted on standard curve to obtain calculated content, and then calculated the average content, standard deviation and recovery (Table 5). Value recovery (recovery)

between 92.43% to 97.10%. These results meet the requirements due to the analyte content  $0.01 < x < 0.1\%$  in the amount of 90-107%. The coefficient of variation are also eligible ie 1.80% (less than 5.3%) (Yowono & Indrayanto, 2005). This means the method meet the requirements, because especially the precision and accuracy have met the requirements, systematic errors which arise in the analysis can be avoided.

Table 5. The results of accuracy test

No.	Actual rutin content (mg/L)	Rutin content From the result of analysis (mg/L)	The results of accuracy test (%)
1.	120	115,91	96,50
2.	120	113,65	94,70
3.	120	113,12	94,26
4.	120	116,52	97,10
5.	120	110,92	92,43
6.	120	113,12	94,26

### 5. Determination of Total Flavonoids Content

The results of the determination of the total flavonoid content 50% ethanolic extract of mangosteen leaves are calculated as hydrolyzed

rutin can be seen in Table 6. The results of the assay 50% ethanolic extract of mangosteen leaves are 42.33%, 27.53% and 10.55% (w/w).

Table 6. The results of the assay was calculated as the total flavonoids rutin hydrolyzed

The origin mangosteen leaf area	Absorbance	Total flavonoid content mg/L	Total flavonoid content%(b/b) In the extract	The average of total flavonoid content%(b/b) In the extract
Banyumas	0,3251	67,69	42,33	26,80 ± 15,9
	0,4261	88,26	27,53	
	0,1587	33,80	10,55	

Mangosteen leaves are extracted with 50% ethanol derived from Banyumas region have relatively high levels of flavonoids, namely 26.80%.

#### Validation Method and Determination of Total Phenol Content

Total phenolic content of ethanolic leaf extract of mangosteen determined using spectrophotometric method referring to previous studies (Scrambled, 2006). Determination of total phenol content which aims to define all content phenols (total) in the ethanolic leaf extract of mangosteen. Prior to the determination of total phenol content to prior validation of methods including linearity, precision, accuracy, of detection limit of the test. Appellant used are Gallic Acid.

#### 1. Preparation of Standard Curve and Linearity

Standard curve was obtained by varying the content that have been hydrolyzed rutin (same method with the sample) was measured at a wavelength of 601 nm maximum. From the data obtained by spectrophotometric absorbance for each concentration (Table 7). The absorbance were plotted with each concentration to make the linear regression equation  $y = bx + \text{equation a}$ . From the relationship curve between absorbance and concentration will be obtained correlation coefficient (r) as a parameter to determine linearity. The results obtained equation has good linearity, because r count (0.9938) is greater than r table (0.811, for N = 6, 95% confidence level) (Hadi, 1996). Standard curve obtained is  $Y = 0.005007 x - 0.304$  is used to determine content total phenols, linear regression curve can be seen in figure 5.

Table 7. Absorbance data and standard curve

No.	Gallic acid content(mg/L)	Absorbance (A)	The result of linear regression
1.	52,86	0,5671	r = 0,9938 a = 0,304 b = 0,005007
2.	78,94	0,6876	
3.	104,80	0,8558	
4.	130,43	0,9314	
5.	155,84	1,1237	
6.	181,03	1,1886	

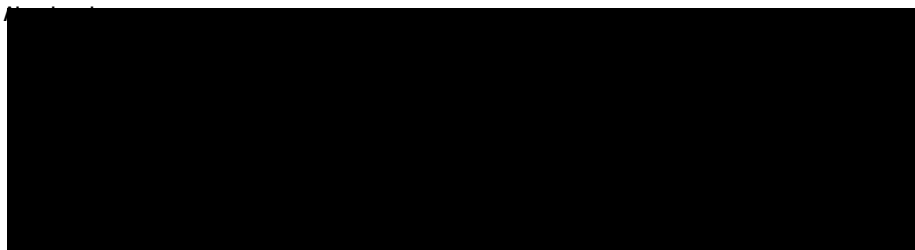


Figure 5. Linear regression standard curve of gallic acid standard

#### 2. Determination of Limit of Detection

To determine the total phenol content in the sample was able to be detected by this method of was measured multiple content gallic acid standard. The measurement results can be seen in the following table. Limit content of standard solutions that can still be detected by spectrophotometric

method is 7,723mg / L. This means that the assay of phenol with standard gallic acid hydrolyzed in samples with spectrophotometric methods measure should be greater than 7,723 mg / L. Figure 6 shows the linear regression curves were created from data from the determination of the minimum limit of

detection with a correlation coefficient of  $r = 0.99132$ .

Table 8. Absorbance data and the result of limit of detection

No.	Gallic acid content (mg/L)	Absorbance	Results of the minimum limit of detection
1.	15,446	0,353	$r = 0,99132$ $a = -0,2311$ $b = 0,0391$
2.	12,357	0,281	
3.	9,268	0,132	
4.	7,723	0,077	
5.	6,179	-0,0044	



Figure 6. Linear regression curve of limit of detection

### 3. Determination of Precision

Precision test is done by making six replication of standard gallic acid which has been hydrolyzed. The absorbance obtained standard curve were plotted on the  $Y = 0.005007x - 0.304$  to get calculated content, and then calculated the

average content, standard deviation and coefficient of variation (Table 9). The coefficient of variation (CV) was 1.91%, less than 5% indicates that this method has a good precision (Peter & Richard, 2000).

Table 9. Absorbance data and ther result of precision test

No.	Absorbance	Gallic acid Content (mg/L)	The results of precision test
1.	1,0774	154,46	Rata-rata = 159,192 SD = 3,048 CV = 1,91% *Tidak dimasukkan karena dianggap alien
2.	1,1063	160,23	
3.	1,0975	158,47	
4.	1,1056	160,09	
5.	1,1187	162,71	
6.	1,2373	186,39*	

### 4. Determination of Accuracy

Accuracy test (closeness) is done by calculating the recovery (recovery) rutin standard that has been hydrolyzed. Recovery percentage was calculated by making a comparison between content results of analysis with actual content. The absorbance obtained were plotted on standard curve to obtain calculated content, and then calculated the average content, standard deviation and recovery (Table 10).

Value of recovery (recovery) between 99.114% to 102.81%. These results meet the requirements due to the analyte content  $0.01 < x < 0.1\%$  in the amount of 90-107%. The coefficient of variation are also eligible ie 1.91% (less than 5.3%) (Yowono & Indrayanto, 2005). This means the method meet the requirements, because especially the precision and accuracy have met the requirements, systematic errors which arise in the analysis can be avoided.

Table 10. The results of accuracy test

No.	Actual gallic acid content (mg/L)	Gallic acid content From the result of analysis (mg/L)	The results of accuracy test (%)
1.	155,84	154,46	99,114
2.	155,84	160,23	102,81
3.	155,84	158,47	101,68
4.	155,84	160,09	102,73
5.	155,84	162,71	101,408

### 5. Determination of Total Phenol Content

The results of the determination of total phenolic content 50% ethanolic extract of mangosteen leaves are calculated as gallic acid can

be seen in the following table. The results of the assay 50% ethanolic extract of mangosteen leaves are 59.23%, 83.96% and 72.64% (w / w).

Table 11. The results of the determination of total phenol content was calculated as gallic acid

The origin mangosteen leaf area	Absorbance	Total gallic acid content mg/L	Total gallic acid content%(b/b) In the extract	The average of total gallic acid content%(b/b) In the extract
Banyumas	04622	31,59	59,23	71,94 ± 12,37
	0,5287	44,87	83,96	
	0,4988	38,90	72,64	

Mangosteen leaves are extracted with 50% ethanol derived from Banyumas area has a large content of phenol is 71.94%.

spectrophotometric method is by using a standard curve alpha mangostin. With the data  $y = 0.019x + 0.057$  to 0.999 linearity. The results of the assay xanthon total 50% ethanolic extract of mangosteen leaves was 1.56%, 2.41% and 1.59% (w / w).

### Determination of Total Xanthon

Xanthon total concentration on ethanolic leaf extract of mangosteen determined by using the

Table 12. The results of the determination of the total xanthon calculated as alpha mangosteen

The origin mangosteen leaf area	Absorbance	Total xanthon content mg/L	Total xanthon content%(b/b) In the extract	The average of total xanthon content%(b/b) In the extract
Banyumas	0,3691	16,42	1,56	5,56 ± 0,48
	0,5656	26,77	2,41	
	0,3739	16,68	1,59	

Mangosteen leaves are extracted with 50% ethanol derived from Banyumas has a total xanthon content relative to the average alpha mangostin is  $5.56 \pm 0.48\%$  w / w%. Spectrophotometric assay method is the same as Aisha et al study (2013) which establishes the fruit skin extracts, and high performance liquid chromatography method on fruit skin extracts on research Yodhnu et al (2009).

Levels of total flavonoids ( $26.80 \pm 15.9\%$  w / w), total phenols ( $71.94 \pm 12.37\%$  w / w) and total xanthon ( $5.56 \pm 0.48\%$  w / w) high in Banyumas because lower temperatures (air temperature ranged from 21.4 to 30.9°C with an average temperature of 26.3°C) and higher light intensity. Mangosteen leaves taken from Somagede located in the mountains near Slamet. Banyumas is located at an altitude of 25 to 500 meters above sea level, there Slamet mountain with a summit elevation of sea level about 3,400 feet and is still active. Weather and climate in Banyumas as classified in the equatorial southern hemisphere still has a wet tropical climate, situated between the slopes of the mountains away from the surface of the ocean shore or sea wind effect is not so apparent (nonyous,

2006c; nonymous, 2002b). Rainfall in Banyumas district that is located on the slopes of Mount Slamet is quite high, 3,439 mm every year, making the soil fertile, mangosteen leaves in this area the width, height and fertile.

## CONCLUSIONS AND RECOMMENDATIONS

### 1. Conclusions

The results of this study it can be concluded:

- Spectrophotometric method can be used for determination of total flavonoid content with the results of the validation are eligible. The results of the determination of the total flavonoid content in the 50% ethanol extract was  $26.80 \pm 15.9\%$
- Spectrophotometric method can be used for determination of total phenolic content with the results of the validation are eligible. The results of the determination of total phenolic content in 50% ethanol extract was  $71.94 \pm 12.37\%$
- Spectrophotometric method can be used to assay total xanthon with linearity results

qualify. Xanthone total assay results in 50% ethanol extract was  $5.56 \pm 0.48\%$

## 2. Recommendations

This research is still a weakness, it is necessary to study more about: determination of the best formulations to be used preservatives disa society.

## ACKNOWLEDGEMENTS

This research was conducted as a research grant from the Private Higher Education Coordinating Region VI, the Ministry of Education and Culture, therefore, we say thank you profusely.

## References

- Aisha, AFA., Abu-Salah, KM., Ismail, Z., Majid, AMSA., 2013, Determination of total xanthones in *Garcinia mangostana* fruit rind extracts by ultraviolet (UV) spectrophotometry, Journal of Medicinal Plants Research Vol. 7(1), pp. 29-35, 3 January, 2013
- Anonim, 1994, Farmakope Indonesnesia, Edisi IV, Depkes RI, Jakarta
- Anonim, 2009, *Manggis*. Deputi Menegristek Bidang Pendayagunaan dan Permasyarakatan Ilmu Pengetahuan dan Teknologi. <http://www.ristek.go.id>. [15 September 2009].
- Anonim, 2006a, *Data Pokok Pembangunan*, [http://www.bantul.go.id/web.php?mod=datapok& Baca=11tinggi\\_tempat](http://www.bantul.go.id/web.php?mod=datapok& Baca=11tinggi_tempat).
- Anonim, 2006b, *Geografis*, <http://bappeda.slemankab.go.id/downloads/Keadaan%20Geografis.pdf>
- Badan POM, 2011, <http://www.klupompi.com/files/8.%20penyuluhan%20keamanan%20pangan/6.%20BTP.pdf>, diakses 23 Januari 2011.
- Badan POM, 2000, Parameter Standar Ekstrak, Depkes RI, Jakarta.
- Backer, C. A, dan Van den Brink, Jr. R. C. B. 1968. *Flora of Java, Vol. II*, Published Under The Auspices of The Rijkher Barium. Lieden.
- Bo, T. & Liu, H., 2004, Separation methods for pharmacologically active xanthones, Journal of Chromatography B, Volume 812, Issues 1–2, 5 December 2004, Pages 165–174.
- Diniatik dan Suparman, 2010, Uji Antioksidan Ekstrak Daun dan Kulit Batang Manggis (*Garcinia mangostana* L) dengan Metode DPPH, Laporan Penelitian LPPM UMP.
- Hadi, S., 1996, *Statistik 2*, Jilid II, Cetakan XVI, Penerbit Andi Offset, Yogyakarta.
- Orak, H.H. 2006, Total Antioxidant Activities, Phenolics, Anthocyanins, Polyphenoloxidase Activities In Red Grape Varieties. Electronic Journal of Polish Agricultural University Food Science and Technology, Volume 9, Issu – 118 htm.
- Peter, C.M and Richard, E.Z., 2000, *Statistical Methods in Analytical Chemistry*, 2<sup>nd</sup> Ed., John Wiley and Sons Inc., New York, 9.
- Suparman dan Diniatik, 2010, Uji Aktivitas Antibakteri Ekstrak Daun dan Kulit Batang Manggis (*Garcinia mangostana* L) Terhadap *Staphylococcus aureus* dan *Escherichia coli*, Jurnal Pharmacy ISSN 1693-3591.
- Yodhnu S., Sirikatitham A., Wattanapiromsakul, C., 2009, Validation of LC for the Determination of  $\alpha$ -Mangostin in Mangosteen Peel Extract: A Tool for Quality Assessment of *Garcinia mangostana* L., *Journal of Chromatographic Science*, Vol. 47, March 2009.
- Yuwono, M. dan Indrayanto, G., 2005, *Validation of Chromatographic Methods of Analysis*, Profiles of Drugs Substances Excipients and Related Methodology.

## FORMULATION AND ANTIOXIDANT ACTIVITY TEST OF LIPSTICK FROM MANGOSTEEN RIND (*Garcinia mangostana* L.) METHANOL EXTRACT

Gigih Aditya Pamungkas\*, Nuryanti, Iskandar Sobri  
Departement of Pharmacy FKIK Jenderal Soedirman University  
Corresponding Author: gigih.aditya@gmail.com

### Abstract

*Cosmetics not just to supporting appearance but also serves to keep the body from the effects of free radicals. The addition of antioxidant compounds from extracts of natural ingredients in cosmetic preparations such as lipstick is one way to inhibit the activity of free radicals. Mangosteen rind has an antioxidant activity similar to vitamin C. This research was made lipstick formulation containing antioxidant compounds from mangosteen rind extract.*

*Lipstick was made 4 formula there was negative control, with methanol extract of mangosteen rind 4 grams, 6 grams and 8 grams. Lipsticks is evaluated to physical properties measurement there was stability test, smear test, pH test, homogeneity test and hedonic test. Formulation are tested the antioxidant activity using DPPH method and compared with brand lipstick which has vitamin E. Analysis of data on the evaluation of physical properties lipstick using descriptive analysis and antioxidant activity test using one way ANOVA.*

*The results showed that extract of mangosteen rind can be formulated into a lipstick that meets requirements of physical properties test preparation. Highest antioxidant activity found in Formula 3 for 61,62% there is higher than brand lipstick for 31,38%. Results of the ANOVA showed significant differences of LSD at each concentration of extracts, any increase in the concentration of the extract in lipstick formulation can increase antioxidant activity.*

**Keywords:** Lipstick, Mangosteen Rind, Antioxidant, DPPH

### BACKGROUND

Nowadays, many manufacturers of cosmetics adding an active substances of a plant into its products as antioxidants. These antioxidant compounds used to counteract the activity of oxidative substances that can damage the body's tissues, which can any decrease in the appearance of a person. Some cosmetic products can be added

antioxidant compounds such as cream, sunscreen and lip colourings (Nugroho, 2012).

Coloring lips or commonly called lipstick is a cosmetic product is very commonly used by women and it is the most important part of that support a woman's appearance. In often conditions, the lips turn into a dry and chapped due to deficiency of antioxidant compounds. The condition of dry lips and chapped can reduce the appearance and level of confidence a woman (Syahjati, 2011).

Mangosteen is a fruit that is favored by the people of Indonesia. Mangosteen has a lot of advantages compared to other fruit. The mangosteen rind can be used as a source of the antioxidant, anticancer and Antidiarrhoeal (Supiyanti *et al.*, 2010).

The mangosteen rind has a great potential for use in traditional medicine industries and cosmetics. Mangosteen can easily be found in Indonesia and the mangosteen rind extract has a high content of antioxidants that the values of IC<sub>50</sub> 8,5539 µg/mL so it can be considered to be added to a material of lipstick (Supiyanti *et al.*, 2010).

### METHOD

#### Time and Place of Research

Research carried out for 2 months in the Plant Taxonomy Laboratory of Biologic Faculty, Farmasetika Laboratories Biology Laboratory of Pharmacy Departement and Chemical Laboratory and Soil Fertility Faculty of Agriculture of Jenderal Soedirman University Purwokerto.

#### Material and Instruments

Materials used in this research is the rind of the mangosteen which is obtained from the area of Sokaraja. The chemicals used is methanol, petroleum ether, methyl paraben, propyl paraben, aquades, cera alba, lanolin, vaseline album, propylene glycol, Cetyl alcohol, methyl paraben, propyl paraben, oleum ricini oleum rosae, oleum cacao, Lip Ice, and 2,2 Diphenyl-1-picryl hydrazil (DPPH). Tools used in this research are glass instruments, water bath, stirring rods, scales, rotary evaporator, mortar and stamper, porcelain cups, filter paper, measuring pipette, UV-Vis spectrophotometer and lipstick container.

### **Processing Material Into Simplisia**

Mangosteen rind washed clean and then sliced into small and then drying on the oven (temperature 70°C) for 8 hours. The dry mangosteen rind being pollinated using blender.

### **Extraction**

500 grams of rind manggis macerated 2x24 hours with 3L methanol 70%. Filtrat was contain resin then washed by fractination with petroleum ether (1:1). Free resin filtrat then viscoused by rotary vaporator until making 82,5 grams viscous extract.

### **Formulations on Lipsticks Preparation**

Mix A made by mixing oleum ricini with mangosteen rind extract which had been dissolved in propylene glycol, then stirred until homogenized. Mix B made by mixing cera alba, lanolin, Vaseline alba, oleum cacao and Cetyl alcohol in the vaporizer cup, then all melted in waterbath. Mix B entered into the mix A then stirred until homogenized. Mixture than added methyl paraben, propyl paraben, and oelum rosae. The mixture was placed into a container of lipstick. Each formulation in replication as much as 3 x. Formulation preparation lipstick can be seen in table 1.

### **Evaluation of Llipsticks Preparation**

#### **Physical stability test of lipstick preparation**

Observation of the changes of shape, colour and smell of lipstick preparations made against each of the preparations at room temperature for storage on day 1, 2, 3, 4, 5, 6, 7, 14, 21 and 28 (Vishwakarma *et al.*, 2010).

#### **Homogeneity test**

Preparation on lipsticks extract rind manggis examined homogeneity by applying some part of lipstick preparation in transparent glass. Preparation must show a visible homogeneity arrangement (Anonymous, 1979).

#### **Smear test**

Smear test visually done by applying lipstick on the skin back of hand then observe colour clinging by 5 times smearing. Preparation has good smearing if has good colour equitable with 3 times smearing (Adliani *et al.*, 2012).

#### **pH test**

250 mg preparation solved in 5 mL aquades. Universal indicators dipped in solution and viewed samples changes color occurring in universal indicators (Adliani *et al.*, 2012)

### **Hedonic test**

Test visually against 30 a survey respondents woman by *accidental survey*. Respondents fill a questionnaire with choose one answer most according to circumstances on lipsticks observed (Adliani *et al.*, 2012).

### **Antioxidant Test**

#### **Making DPPH solution**

0,0045 grams of DPPH included into measured flask 100 mL, then added methanol until the volume of 100 mL, stirred up into perfect solution and settled in a dark place (Bernatoniene *et al.*, 2011).

#### **$\lambda$ max determination**

3 mL DPPH solution pipetted and added with 1 mL of methanol. Solution inkubated appropriate inkubation time then measured by absorption solution of the spectrophotometer uv-vis on wavelengthth 400-800 nm with blanko methanol.

#### **Operating time determination**

Operational time determinated by incubating sample solution and measured the absorbance using UV-Vis spectrophotometer.

#### **Validation of method**

The validation was done by making the raw curve and linierity of DPPH solution. Accuracy and precision was measured from DPPH solution.

#### **Making sampel solutions**

From each sample and lipstick comparator (Lip Ice) taken 1 gram solved with 10 mL petroleum ether then fraksinated with 10 mL methanol in a separating flask. Fraksination was carried out 3x. Methanol-soluble fraction were taken and used as the sample solution (Bernatoniene *et al.*, 2010).

#### **Antioxidant activity testing**

Each sample concentration pippeted 1 mL, then added 3 mL DPPH solution 4.5 µg/mL. Solution homogenated and waited for inkubation time on place escape from the light, then its absorbance was measured at the time of oprasional time (Bernatoniene *et al.*, 2010).

#### **Data Analysist**

Data evaluation results of physical properties, pH, homogeneity smearing and hedonic test analyzed by descriptive. Antioxidant activity of each formula was calculated from the value of percent reduction of DPPH and analyzed using one-way ANOVA with 95% confidence level.



Figure 1. Methanol Mangosteen Rind Extract Lipstick

Table 1. Lipstick Preparation

Materials	F1 (gram)	FII (gram)	FIII (gram)	FIV (gram)
Ekstrakt	4	6	8	0
Lanolin	8	8	8	8
Vaselin album	26	26	26	26
Cetyl alkohol	6	6	6	6
Oleum cacao	4	4	4	4
Propilen glikol	5	5	5	5
Metil praben	0,1	0,1	0,1	0,1
Propil paraben	0,1	0,1	0,1	0,1
Oleum rosae	0,1	0,1	0,1	0,1
Coloring	3	3	3	3
Erithrosine	46,50	44, 70	42,70	50,70
Cera album + oleum ricini (6:4)				
Total	103	103	103	103

## RESULT AND DISCUSSION

Results of observations of lipstick preparations indicates that all formulas has not changes in shapes and colors for 28 days of storage. The color of the lipstick preparations was different for each formula, the higher extract concentration was make generated the darker color. Difference of color of lipstick can be seen preparations on Figure 1. Observation on odor formula 4 (without the extract), more quickly reduced smells in comparison to another formulas. The smell observation result can be seen in table 2.

Homogeneity was one of the traits of a good semisolid preparations. Lipstick that forms a homogenous structure can be said that have the same active substance levels at each usage (Kurniawan *et al.*, 2012). The observations of its homogeneity of the mangosteen rind extract lipstick preparations for 28 days of storage indicates that all formulas in the preparations of the mangosteen rind extract lipstick has good homogeneity, because it does not feel the presence of coarse grains on a plate.

Tabel 2. Odoris Stability of Lipstick Preparation

Storage Time (day)	Odoris Stability			
	F1	F2	F3	F4
1	++++	++++	++++	++++
2	++++	++++	++++	++++
3	++++	++++	++++	++++
4	++++	++++	++++	++++
5	++++	++++	++++	+++
6	++++	++++	++++	+++
7	++++	++++	++++	+++
14	+++	+++	+++	++
21	+++	+++	+++	++
28	++	+++	+++	+
Description :	- : no oleum rossae smell ++ : smell of oleum rossae +++ : strong smell of oleum rosae ++++ : very strong smell of oleum rosae			



Table 3. Smear Test of Lipstick Preparations

Storage Time (day)	Number of Smearing			
	F1	F2	F3	F4
1	3x	3x	2x	4x
2	3x	3x	2x	4x
3	4x	3x	3x	4x
4	4x	3x	3x	4x
5	4x	4x	3x	4x
6	4x	4x	3x	4x
7	4x	4x	3x	4x
14	4x	4x	4x	5x
21	5x	4x	4x	5x
28	5x	4x	4x	5x

Table 4. pH Test of Lipstick Preparations

Storage Time (day)	pH			
	F1	F2	F3	F4
1	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
2	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
3	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
4	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
5	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
6	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
7	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
14	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
21	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0
28	6,0±0,0	6,0±0,0	5,0±0,0	6,0±0,0

The smear test results in table 3 show that lipstick formula 3 has the best smear capacity with 2x applications, then followed by lipstick formula 2, formula 1 and the last was formula 4. Smear Capacity of preparations was good if the colors that stick to the skin of back hands was a lot evenly with 3 times applications (Adliani *et al.*, 2012).

Measurements of the pH of the lipstick preparations for 28 days of storage at table 4, shows that the mangosteen rind extract lipstick preparations have a stable between pH 5-6. The skin normal circumstances has a pH range from 4.5-6.0 (Akhtar *et al.*, 2010). According to Farida *et al.*, (2007) the pH of cosmetics according to SNI-16-4946.2 -1998 was 4.5-7. On all formula, pH values are still at a pH range allowed for material of cosmetic and skin.

Hedonic test results of 4 formulations show that colour homogeneity of lipstick formula 1 and 2 are preferred than another lipstick formula. The most preferred soft surface of lipstick preparation was formula 4. The most preferred easy smearing of lipstick preparation was formula 3. Homogeneity as color was applied to skin the most preferred was formula 2. On the whole the most lipstick preparations was a formula 2 because it has the highest score of total value.

Antioxidant activity extract mangosteen rind extract lipstick was tested using DPPH methods. A compound have antioxidant activity if those compounds have capability to donated their atoms hydrogen to free radical DPPH. It is characterized by changes in purple color becomes yellow pale. Antioxidant activity counted as a percentage reduction dpph (Molyneux, 2004 ).

Table 5. Antioxidant Activity of Lipstick Formulation

Sample Test	Reduction Presentage DPPH*
Formula 1	39,78±2,76
Formula 2	51,34±3,65
Formula 3	61,62±0,74
Formula 4	6,93±3,01
Lip Ice	31,38±2,47

\*average result ± deviation standard 3 replication

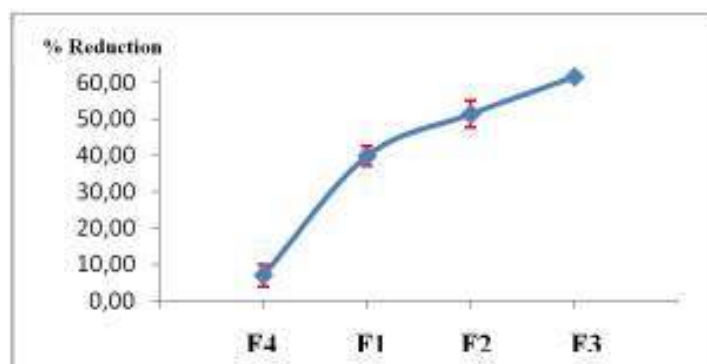


Figure 2. Reduction Presentage Average of Lipstick Formulation

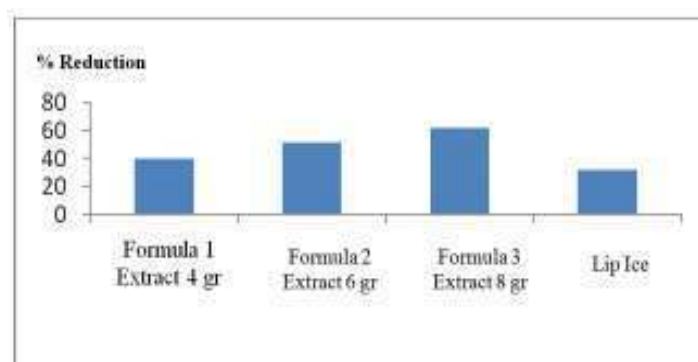


Figure 3. Comparison Between Lipstick Formulation and Lip Ice

Antioxidant activity test was done 1 days after making. Maximum length by wave used is 515,5 with incubation periods 25 minutes and operational time five minutes. Measurement result antioxidant activity on lipsticks extract skin preparation manggis can be seen on the table 5.

Based on the data contained in Table 4.8, the mangosteen rind extract formulated for daily active preparations to be lipsik in Formula 3 and Formula 2 have antioxidant activity with the highest reduction percentage > 50%. It showed that the antioxidant activity extract of mangosteen rind after being formulated for daily active preparations lipstick was quite high. A material was said to be active as a reducer of free radicals if it has a reduction percentage was greater than or equal to 50% (Bernatoniene *et al.*, 2010). The reduction percentage have different values for each formula. The highest percentage was Formula 3 (extract of mangosteen rind 8 grams) of 61,62% then followed by a Formula 2 (extract of mangosteen rind 6 grams) of 51.34% and Formula 1 (extract of mangosteen fruit skin 4 g) of 39,78% while for Formula 4 (extract of mangosteen rind 0 grams) as negative control has only the percentage of

reducing of 6,93%. Reduction presentage grafic can be seen on figure 2.

Based on tests of normality using Shapiro wilk test and homogeneity test using *levene* show  $p > 0.05$ , which means that the data was distributed normally and homogeneous, so that it can be processed using the parametric One-way Anova test. Anova analysis results showed significance  $p = 0.000$  ( $p > 0.005$ ), it means there has a significant difference from treatment groups. The average of reduction presentage in Figure 2 shows an increase in the reduction percentage DPPH with mangosteen rind extract in preparations, namely lipstick Formulation 1 (4 grams), Formulation 2 (6 grams) and Formulation 3 (8 grams) by the reduction percentage 51.34%, 39,78%, and 61,62. Anova test results indicate that there was a difference of LSD means ( $p < 0.005$ ) for each formula. That means the higher the mangosteen rind extract was added to the lipstick preparations can increase the reduction percentage of DPPH.

Results of the validation method of DPPH, the methods which used have a good linearity with the largest correlation coefficient ( $r$ ) was 0,993. This method also has good accuracy and precision with a

value of% Recovery range was 93,38-102,89% variation coefficient value (CV) was 4.02%.

In Figure 3, reduction percentage values of of the branded lipsticks containing vitamin E was 31,38%. This value was smaller than the value of the reduction percentage Formula 1, Formula 2 and Formula 3. This showed that the antioxidant activity of the extracts of preparations of lipstick mangosteen rind was higher compared to the branded lipsticks preparations containing vitamin E, which has been circulating in the market.

### CONCLUSSION

Methanol extract of mangosteen rind can be formulated into lipstick preparation that passed the test of physical stability. Lipstick preparation from mangosteen rind (*Garcinia mangostana* L.) methanol extract lipstick has the highest antioxidant activity in Formula 3 with the addition of 8 grams methanol extract of mangosteen rind with the reduction presentage value was 61,62%.

### References

- Adliani, N., Nazliniwyaty, dan Purba, D., 2012, Formulasi Lipstik Menggunakan Zat Warna dari Bunga Kecombrang (*Etlingera elaitior* J.), *Journal of Pharmaceutics and Pharmacology*, Vol.1 No.2 Hal. 87-94
- Akhtar, N., Khan, B.a., Khan, M.S., Mahmood, T., Khan, H. M. S., Iqbal, M., dan Bashir, S., 2011, Formulation Development and Moisturising Effect of a Topical Cream of *Aloe Vera* Ekstrakt, *World Academy of Science Engineering and Technology*, Vol. 34 No. 1 Hal. 172-180.
- Anonymous, 1979, *Farmakope Indonesia Edisi III*, Departemen Kesehatan Republik Indonesia, Jakarta.
- Bernatoniene, J., Masteikova, R., Davalgienne, J., Peciura, R., Gauryliene, R., Bernatoniene, R., Majiene, D., Lazauskas, R., Civinskiene, G., Velziene, S., Muselik, J., dan Chalupova, Z., 2011, Topical application of *Calendula officinalis* (L.): Formulation and evaluation of hydrophilic cream with antioxidant activity, *Journal of Medicinal Plants Research*, Vol. 5 No. 6 Hal. 868-877
- Farida, I., Kardian, A., dan Sa'diah, S., 2007, Uji Pendahuluan Efektivitas dan Sediaan Gel Minyak Serai Dapur (*Cymbopogon citratus* (DC) Stapf) Terhadap Nyamuk *Aedes Aegypti*, *Jurnal Ekologia*, Vol. 7 No. 1. Hal 177-184.
- Kurniawan, D.W., Wijayanto, B.A., dan Sobri, I., 2012, Formulation and effectiveness of antiseptic hand gel preparations essential oils galanga (*Alpinia galanga*), *Asian J Pharm Biol Res*, Vol. 2 Hal. 245-249.
- Nugroho, A.E., 2012, *Manggis (Garcinia mangostana L.) : Dari Kulit Buah yang Terbuang Menjadi Kandidat Suatu Obat*, Universitas Gajah Mada, Yogyakarta.
- Molyneux, P., 2004, The Use of The Stable Free Radical Diphenylpicrylhydrazyl (DPPH) for Estimating Antioxidant Activity, *Songklanakarin J. Sci. Technol*, Vol. 26 No. 2 Hal. 211-219.
- Nugroho, A.E., 2012, *Manggis (Garcinia mangostana L.) : Dari Kulit Buah yang Terbuang Menjadi Kandidat Suatu Obat*, Universitas Gajah Mada, Yogyakarta
- Supiyanti, W., Wulansari, E.D., dan Kusmita, L., 2010, Uji Aktivitas Antioksidan dan Penentuan Kandungan Antosianin Total Kulit Buah Manggis (*Garcinia mangostana* L), *Majalah Obat Tradisional*, Vol.15 No.2 Hal.64-70.
- Syahjati, T.I., 2011, Formulasi dan Uji Aktivitas Antioksidan Sediaan Lipstik Ekstrak Etanol Herba Tali Putri (*Cuscuta australis* R.Br.) (*Skripsi*), Fakultas Farmasi Universitas Muhammadiyah, Purwokerto.
- Vishwakarma, B., Dwivedi, S., Dubey, K., dan Joshi, H., 2011, Formulation and Evaluation of Herbal Lipstick, *International Journal of Drug Discovery and Herbal Research*, Vol.1 No.1 Hal.18-19

## THE ROLE OF MEDIA EXPOSURE AND HEALTH BELIEF ON BREAST SELF EXAMINATION

Khamidah Achyar,<sup>1</sup> Anita D. Anwar,<sup>2</sup> H. Herry Garna<sup>2</sup>

<sup>1</sup>University Muhammadiyah Purwokerto, <sup>2</sup>Padjadjaran University

### Abstract

*Breast self-examination (BSE) is an early detection of breast cancer which is easy, safe, and free. It is important for every woman. The purpose of the study is to analyze knowledge correlation, information media exposure, and health beliefs with BSE. The research method was analytic cross-sectional design. The study was conducted in the work area of Plered Cirebon District Health Center in September to November 2012. The samples were the participants of hormonal acceptor among 139 women using pills and injections. The data analysis used chi-square, phi cramer, and multiple logistic regression. Fourty seven of one hundred thirty nine (33.8%) of respondents did the BSE. The result of the study showed that there is a significant difference and a positive correlation among information media exposure ( $p=0.046$ ;  $r=0.169$ ) and health beliefs factors (susceptibility, health motivation, confidence) toward BSE, ( $p<0.000$ ,  $p<0.001$ ,  $p<0.001$ ). The closeness of each variables correlated were low and moderate ( $r=0.253$ ,  $r=0.365$ ,  $r=0.345$ ,  $r=0.345$ ). The conclusion of the study is the information media exposure and health beliefs (susceptibility, health motivation) can improve the implementation of BSE.*

**Keywords:** BSE, Health believe, Media exposure

### BACKGROUND

BSE is one way of early detection of breast cancer is easy, safe, and free. BSE is abnormalities in the majority (80%) were found by the woman in question. Early diagnosis and proper treatment will increase the breast cancer cure rate approaching 100%.<sup>1</sup> Women who have a history of using pills and injection contraceptives within 5 years or more significantly increased the risk of breast cancer by 1.57 times on the contraceptive pill users and 1.83 times the contraceptive injection.<sup>2</sup>

Data from the Hospital Information System (SIRS) of breast cancer patients in Indonesia in 1998, 2004, 2007, and 2008, respectively successive 12.2%, 15.4%, 16.85%, and 18.4%.<sup>3</sup> In 2011 a report by the hospital in Cirebon that breast cancer cases tripled from 92 cases of cervical cancer are women with breast cancer and 36 cases

of cancer patients serviks.<sup>4</sup> This resulted in increased morbidity and mortality of women, loss great material, as well as the psychological high impact.<sup>5</sup>

BSE is promotive prevention of breast cancer, but in fact very few are doing it. BSE is the low implementation (31.7%) largely due to the ignorance and incompetence factor in doing so, lower education, and considers himself not risk.<sup>6</sup> Some other factors that influence BSE the behavior that perceptions about breast cancer, exposure information, knowledge, and education.<sup>7</sup> Media information on the topic that is memorable message with respect to breast cancer is early detection, awareness of the disease, treatment, and preventive.<sup>8</sup>

Health belief behavior predictors BSE that perceived barriers factor of the individual and self-confidence in taking preventative.<sup>9</sup> women who have higher levels of knowledge have better awareness in implementing BSE that is equal to 1.8 kali.<sup>10</sup> BSE implementation is generally done by women who have a history of breast cancer in her family.<sup>11</sup>

### METHODE

Analytical research with a cross sectional design, using questionnaires to 139 female participants in the hormonal acceptor Puskesmas Plered Cirebon in September-November 2012. Criteria for inclusion in this study are participants pills and injections contraceptive, are not breastfeeding period, and can perform BSE. Exclusion criteria are women who found abnormalities/lump in the breast. Sampling technique with consecutive sampling. Data analysis using the chi-squared to determine the role of the relationship between variables and to determine the degree of relationship using Cramer phi.

### RESULT AND DISCUSSION

The results showed that the age of the study subjects who did BSE over 30 years as much as 34% with a senior high school as much as 31%. There is a positive relationship between knowledge, information media exposure, and health beliefs (susceptibility, motivation, self-confidence) by BSE

with  $p < 0.05$ . Various variables that have a positive correlation with the participants aware of each hormonal contraceptive were knowledge, media exposure, vulnerability, motivation, and confidence. The relationship of each of these variables, were knowledge and information media exposure a weak correlation ( $r < 0.3$ ), as well as vulnerability, motivation, and middle self-confidence correlation ( $r > 0.3$ ).

Results of multiple logistic regression POR obtained by 5.004 (from 1.977 to 12,665), this means that the participants were exposed to hormonal contraceptive, information media 5 times higher than in doing BSE that no media exposure information. The results of bivariate analysis showed age was no significant difference between the age group of 30 years and older than 30 years in BSE ( $p > 0.05$ ). Age in this study is a confounding variable because other variables influence the results of the difference in crude POR POR adjusted and more than 10%.

These results together with the results of research and Tavafian et al.<sup>9</sup> and Parisa et al.<sup>12</sup> that age is not related to BSE. Age as individual characteristics rather than as an indicator for changes in behavior, which is necessary for the realization of the implementation BSE better health education is continuous.

The behavior is a form of stimulus response. Individual's response is very dependent on the individual characteristics. Although stimulating the same but the response of each individual is different. This is caused by behavioral determinants that include internal and external factors of the individual concerned. Age as individual characteristics, the level of maturity is determined by environmental factors. Based on research Ghanem,<sup>13</sup> that age, occupation, and trust is not significantly related to BSE. Be aware of behavior can be improved through education programs and increase knowledge about breast cancer.

Some of the reasons are found in this study, participants who did not perform hormonal contraceptive is BSE caused by busyness for a living, do not have time to feel, forget, and feel important. Increasing age is not always in line with the increasing level of maturity. Positive behavior change in participants hormonal contraceptive increasing age above 30 years due to internal factors that feel themselves at risk for breast cancer.

Education to BSE based on the results of the chi-square test analysis there was no significant difference in hormonal planning participants ( $p > 0.05$ ). Education variable in this study is not a confounding variable after controlling for other

variables did not affect the results of the difference in crude POR. POR adjusted and less than 10%. The results of this study differ from Gurdal et al.<sup>10</sup> research and Sim et al.<sup>14</sup> stating BSE significant influence on the level of education. A very important factor to do BSE that awareness and education level, the higher the education level, the more care in the early detection of breast cancer.

In the present work will be done by the participants aware of the hormonal contraceptive feel a significant difference to the implementation of planning participants aware of the hormonal. Participants were highly educated hormonal contraceptive majority do not BSE, some women find lumps reasonable fear if BSE and do not feel it is important to do so.

Results showed that participants who did BSE hormonal contraceptive with high knowledge as much as 38%. Based on bivariate statistical analysis using the chi-squared test significant difference of high and low knowledge with the participants aware of the hormonal contraceptive ( $p < 0.05$ ). Results of logistic regression, knowledge of breast cancer risk factors with POR has BSE 4.680 (1.369 to 15,999) means that the value of 4.68 times greater chance of doing BSE the planning participants who have knowledge of hormonal factors in breast cancer risk compared with the low knowledge.

The results of this study together with the study Ghanem,<sup>13</sup> states that knowledge of breast cancer risk factors will affect BSE. Knowledge of risk factors significantly associated with the implementation of BSE. The higher one's knowledge about breast cancer risk factors, the higher the level of awareness for early detection. One way of early detection of breast cancer is made is aware of the practice.

According Moodia et al.<sup>15</sup> increasing one's knowledge with increasing levels of education. Knowledge significantly related to BSE. Students as research subjects who are given knowledge about breast cancer through video playback can increase their knowledge and become better aware of the behavior.

Participants hormonal contraceptive support medical staffs who perform BSE as much as 36%. Statistical analysis by chi-square, there was no significant difference between participants who received acceptor hormonal support and medical staffs who do not have the support of medical staffs ( $p > 0.05$ ).

These results differ from the results of research Ferris et al.<sup>16</sup> medical staffs expressing support given to participants card through acceptor

hormonal services by posting schedule will remind implementation BSE is better.

Participant in this study did not BSE. BSE is the benefits due to less perceived as a precautionary measure the intensity of the disease and the lack of medical staffs in providing health education BSE. Behavior can be changed only when the given stimuli actually exceeds that of the original stimulus. Stimulus accepted to get attention will encourage the willingness to act and BSE if there is a driving factor of the environment in the form of support personnel and facilities kesehatan.<sup>8</sup>

Interventions are given to change the behavior of the officer in line with the results of the study Aghamolaei et al.<sup>17</sup> that health education given to the students about the prevention of breast cancer can increase the knowledge and BSE execution frequency.

Results showed that participants who are exposed to the hormonal acceptor information media that does BSE by 51%. Bivariate statistical test results showed that there were significant differences between participants who are exposed to hormonal acceptor information and the media did not ( $p < 0.05$ ). Results of multiple logistic regression obtained POR 5.004 (1.977 to 12,665), this means that the participants were exposed to hormonal acceptor information media 5 times higher than in doing BSE that no media exposure information.

The results of this study together with Smith et al.<sup>8</sup> research that the more exposure, the better the information behavior BSE it. News items submitted will make listening to the news recipient receives new information that will ultimately change a person behave in accordance with the message of the story. Admission news content will lead to interest someone that will cause a positive response which will transform into behavior. A woman will be longer store information.

Media information can be used as a motivating factor for the implementation of television BSE, BSE posters mounted in places where health care and public places accessible to all people, and social media. The media very effectively to influence others. Figures are expressed in the media is the most influential factor for the figure can be aware of the practice of giving an example. Ferris et al.<sup>16</sup> study showed a significant correlation between BSE image affixed to the card and aware of acceptor services. Imitative behavior is a form excitatory associations with other stimuli. The behavior of the model will influence the behavior of imitators.

The results showed that confidence in the health factors associated with the participant hormonal acceptor BSE that vulnerability, health motivation, and confidence. The results of bivariate statistical test showed significant difference hormonal acceptor participants who have a high susceptibility, high health motivation, and confidence to BSE ( $p < 0.001$ ,  $p < 0.001$ ,  $p < 0.001$ )

POR multivariable test results obtained on subvariabel vulnerability of 3.585 (1.387 to 9.226). This means that participants who have a hormonal acceptor susceptibility to breast cancer have a greater chance of doing BSE as much as 3,585 times compared to non-vulnerable. Health motivation prevalence ratio 4.246 (1.605 to 11.23), thus the hormonal planning participants who have health motivation will have a chance of doing BSE greater than 4.246 times that do not have the motivation.

The most influential factor in the results of this study BSE that feel themselves at risk of developing breast cancer, have a family history of breast cancer, and are motivated to listen to health information from television news.

These results together with the results of the study Brain et al.<sup>11</sup> that women who feel anxious because of the higher family history of breast cancer will be associated with a success rate BSE better. Anxiety felt by women due to the susceptibility to breast cancer experienced by family members. The results of the study were to evaluate the effect of Aghamolaei et al.<sup>17</sup> education programs BSE that the groups with higher confidence was significantly related to BSE success in implementation practices.

Based on the results of the study revealed that the implementation Tavafian et al.<sup>9</sup> BSE significantly associated with the health trust factor is susceptibility, barriers, and self efficacy. Fewer barriers to doing and BSE high self-efficacy will increase BSE a better implementation. Self efficacy is the ability of self-assessment in the implementation of BSE. In this study also revealed that due to the lack of implementation BSE socioeconomic status, lack of knowledge about breast cancer, low levels of education, lack of knowledge neighbor BSE implementation, and family history of breast cancer were negative. Family history of breast cancer was not associated with the implementation of BSE.

These results differ from the results of research Ceber et al.<sup>18</sup> stating that the health belief variables associated with the BSE that little obstacle and confidence. The benefits derived and not related to health motivation BSE

implementation. Family history of breast cancer affects the susceptibility and seriousness of the disease. Someone who has a higher confidence, fewer barriers to doing BSE better. Based on research and Secginli Nachivan,<sup>19</sup>. BSE the women who do have reason to feel the benefits of high and have high confidence to be able to do so. The higher a person's health motivation, BSE it the better implementation, as well as higher self-efficacy score, the greater the chances of success doing BSE.

### CONCLUSSION

Conclusions of research that there is a relationship with a low to moderate correlation value between media exposure and confidence in health information with BSE.

### References

1. Bobak IM, Lowdermilk DL, Jensen MD, Perry SE. Buku ajar keperawatan maternitas. Edisi ke-4. Jakarta: EGC; 2005.
2. Urban M, Banks E, Egger S, Canfell K, O'Connell D, Beral V, dkk. Injectable and oral contraceptive use and cancers of the breast, cervix, ovary, and endometrium in black south african women: case-control study. Pubmed. 2012;9(3):e1001182.
3. Sistem Informasi Rumah Sakit. Jakarta. Depkes RI; 2008.
4. Laporan data Rumah Sakit. Cirebon: RSUD Waled; 2011.
5. Hawari D. Kanker payudara dimensi psikoreligi. Jakarta: FKUI; 2004.
6. Ibrahim NA, Odusanya OO. Knowledge of risk factors, beliefs and practices of female healthcare professionals towards breast cancer in a tertiary institution in Lagos, Nigeria. BMC Cancer. 2009;9:76.
7. Desanti OI. Persepsi wanita tentang kanker payudara dan perilakunya dalam melakukan pemeriksaan payudara sendiri (Sadari): studi terhadap wanita berisiko kanker payudara di Kota Semarang Jawa Tengah (Tesis). Jogjakarta: UGM; 2008.
8. Smith SW, Nazione S, Laplante C, Kotowski MR, Atkin C, Skubisz CM, dkk. Topics and sources of memorable breast cancer messages and their impact on prevention and detection behaviors. J Health Commun. 2009;14(3):293-307.
9. Tavafian SS, Hasani L, Aghamolaei T, Zare S, Gregory D. Prediction of breast self-examination in a sample of Iranian women: an application of the health belief model. BMC Women's Health. 2009;9:37.
10. Gurdal SO, Saracoglu GV, Oran ES, Yankol Y, Soybir GR. The effects of educational level on breast cancer awareness: a cross-sectional study in Turkey. Asian Pac J Cancer Prev. 2012;13(1):295-300.
11. Brain K, Norman P, Gray J, Mansel R. Anxiety and adherence to breast Self-examination in women With a family history of breast cancer. Psychosomatic Med. 1999;61:181-7.
12. Parisa P, Kandiah M, Zulkefli NAM, Rahman HA. Knowledge and behavior regarding breast cancer screening among female teachers in Selangor, Malaysia. Asian Pacific J Cancer Prev. 2008;9:221-8.
13. Ghanem S. Knowledge of risk factors, beliefs and practices of female healthcare professionals towards breast cancer, Morocco. Pan African Med J. 2011;10:21.
14. Sim HL, Seah M, Tan SM. Breast cancer knowledge and screening practices: a survey of 1,000 Asian women. Singapore Med J. 2009;50(2):132.
15. Moodia M, Balali MM, Sharifirad GR, Shahnazid H, Sharifzadehe G. Evaluation of breast self-examination program using health belief model in female students. JRMS. 2011;16(3):316-22.
16. Ferris DG, Golden NH, Petry LJ, Litaker MS, Nackenson M, Woodward LD. Effectiveness of breast self-examination prompts on oral contraceptive packaging. J Fam Pract. 1996 Jan;42(1):43-8.
17. Aghamolaei T, Hasani L, Tavafian SS, Zare S. Improving breast self-examination: an educational Intervention based on health belief model. Iran J Cancer Prev. 2011;2:82-7.
18. Ceber E, Yücel U, Mermer G, Özentürk G. Health beliefs and breast self-examination in a sample of turkish women academicians in a university. Asian Pacific J Cancer Prev. 2009;10:213-8.
19. Nahcivan NO, Secginli S. Health beliefs related to breast self-examination in a sample of Turkish women. NCBI. 2007;34(2):425-32.

## PHENOMENOLOGY STUDY OF VARIOUS OBSTACLE EFFORTS TO ELIMINATE OF DENGUE HAEMORAGIC FEVER IN BANYUMAS DISTRICT

Isna Hikmawati, Dedy Purwito

### **Abstract**

*Dengue fever is an illness that is now internationally paid attention with more than 50 millions cases each year. In Indonesia the prevalensi of dengue fever is still high. On 2007 there are 71 cases for each 100.000 people and the percentage of mortality reaches 1,010% for each 100 patients of this illness. The are 12 provinces which have been noted as the great case area/KLB of dengue fever (anonymy,2004). Every years this epidemic always happen. One of cause decreasing of effectiveness of mosquito's vector control and also the wrong view about the treatment of dengue fever as well as narrow participation of community in vector control. The Research purpose to identification various obstacle efforts to eliminate of dengue haemorrhagic fever from agent factors, host factors and environment factors. Research design is qualitative with fenomenologi approach. Informant consist 8 participant from two distric recent and long time of endemic. Take of data with interview, observation and sheet of data self. The Result of research that obstracle of vectors elimination are from agent not yet vactination, and community have breeding place of aedes aegypti. Obstracle of host, community participation of vector control and role of health official in health education not yet maksimum. Obstracle of environment cleanliness of environment not yet optimum, so will cause of risk transmtion of DHF as communicable diseases in community. Conclusion this research to prevention of dissemination dengue haemorrhagic fever from agent, host and environment factors be needed participation of community be continue in activity of elimination breeding place aedes aegypti, as well as support from health official.*

**Keywords:** *Fenomenologi, Obstacle, eliminate of dengue haemorrhagic fever*

### **BACKGROUND**

Dengue is a diseases that becomes international attention with amount of cases in all of the world achieve 50 millions per year. In Indonesia, the prevalence of dengue still high enough, in 2007 it was registered 71 peoples per 100.000, while the died victim achieve 1,010% per

100 sufferer, and it was 12 province that stated as a zone of outbreak of dengue (KLB). In Desember 2008, Banyumas district becomes a territory outbreak of dengue, after 685 citizens was stricken by dengue, and nine of them was died. In 2002, Banyumas becomes a sequential region of prevention dengue program. This outbreak caused by raising endemic area in Banyumas, which is from 29 country become 41 country. It is probably lack of effective mosquito vector and also there was a mistaken in handling DBD and the role of society in eliminating the mosquito nest is still lack. Finally, the strategy of elimination DBD can not be carrioud out well. So that, Indonesia always be shadowed by the outbreak of dengue in every year

There were many obstacle in eliminating DBD, such as : most of the Indonesian people not realize the important of keeping the cleanness, and also the habit of the society to accommodate the water. Incertain area that the taste of water is salty and the availability of drink water is not regular, people accustom to accommodate the clean water in a drum that can be filled with 200 liter water and the water is accommodated for a long time. That drum becomes a place for breeding aedes aegypti. Meanwhile, in a region with good water availability, most of peoples is also accommodate the water in bathtub. It is because, peoples are happier to take a bath using water dipper than shower. Though the water in bathtub always used but usually not until used up so that the larva is still stay in that place. Beside that, if there is a movement. Larva will move into beneath so that it is not expelled at the time of water taken. Other habit that can also obstruct in eliminating DBD is not deplete the bathtub regularly. Tough most of the society was deplete regularly, usually they deplete the bathtub with a wrong way. The drain mostly done by replacing the water without brushing the wall. That way is not effective because the eggs of aedes aegypti still stick in the wall. The egg of aedes aegypti can live until 6 month so that if they are not removed, they will continue their live ciclus.

From those cases, it needed to know the obstacle in eliminating DBD, so that the expectations can found the most effective strategy toward the elimination DBD, as an affort to prevent the outbreak. By approaching fenomology, it is



expected that the sort of obstacle can be explored by society in order to elimination DBD.

## RESEARCH PURPOSES

### 1. General Purpose

Doing fenomology study from many obstacle in eliminating DBD in Banyumas district

### 2. Particular purposes

- Identify the various elimination obstacle vector DBD from agent aspect (germs), such as the existence of larva (container indeks)
- Identify the various elimination obstacle of DBD from host aspect (human) such as the role of society in participation with eradication of breeding place and the role of medical officer in health education.
- Identify the various elimination obstacle of DBD from environment aspect, such as the quality of physic environment or social environment.

## RESULTS AND DISCUSSION

### DATA ANALYSIS

#### 1. Characteristics of Informants

No	Id	Age	Education	Job	Ever given Penkes dbd
1	SS	45 <sup>th</sup>	Under graduate	Teacher	Ever
2	SP	62 <sup>th</sup>	Bachelor	Retired Teacher	Ever
3	MS	34 <sup>th</sup>	Primary	Traders	Yet
4	SM	45 <sup>th</sup>	Primary	Farmer	Yet
5	UH	30 <sup>th</sup>	Under graduate	Nursing	Ever
6	KT	64 <sup>th</sup>	Junior High School	Housewife	Ever
7	NH	49 <sup>th</sup>	High School	Traders	Ever
8	SL	56 <sup>th</sup>	Primary	Farmer	Ever

#### 2. Observations

The results of observation emphasizes the physical aspects such as the availability and state shelters water, environmental hygiene conditions both inside and outside the home.

#### 3. Interview Results

Below are the results of research interviews with informants related to the objectives and research questions.

##### a. Identify barriers eradication of dengue vectors aspect agents (germs), includes the presence of larvae (container index)

Based on the interviews can be identified several possible presence of larvae in containers owned by informants:

## RESEARCH METHODS

### Design Research

Qualitative study with a phenomenological approach

### Informant

Sampling was purposive sampling. Based on the existing theory, the number of samples in qualitative research between 5-8 (Angraeni, M & Saryono, 2010). Informants in this study were 8 people from endemic and not endemic districts

### Guidelines And Data Collection Method

Data collection using interviews and observations

### Data Analysis

The steps in analyzing the data:

- Transcribing interviews and observation reports
- Analyzing the results of the interview transcripts and observation reports
- Seeking categories
- Describing Category
- Discussion of research findings

- The permanent water storage (TPA) which shelter for daily household use, in general, the state of the water is clear, calm and not flow like bathtubs, toilets, water storage drums and others
- Not water reservoirs (non- TPA) is a container or a container that can hold water, but not for everyday purposes such as drinking places pets, used goods (tires, cans, bottles, broken plates/cups), vases or pots flowers and others.
- The natural breeding. Not a water reservoir but naturally can be a reservoir of water such as a piece of bamboo, fence holes, leaf midrib containing water and used a coconut shell filled with water.

According Widiyanto, T, (2009). Various studies have been conducted on mosquito breeding is found that :

- 1) The natural breeding is preferable when compared with non- natural
- 2) Type of clay and bamboo containers most favored when compared cement containers, glass/glass, aluminum and plastic containers of bright colors (brown, yellow and red) is preferred as a breeding ground.  
The deeper the water surface distance to the surface vessel more larvae obtained.

**b. Identify barriers dengue eradication of aspects host (human), namely the lack of community participation in the PSN. Forms of community participation that can be done:**

1. Drain the tub, vessel, container/other water reservoirs, at least 1 X/Mg, because of the development into mosquito eggs take 7-10 hr
2. Cleaning the yard, so it does not become a nest vector.
3. Making good home lighting and avoid clothes hung, which provide opportunities mosquitoes rest, dispose of

used goods in the space provided/bury, giving abate the water which are difficult to clean. In addition, the role of health workers in health education is not optimal

**c. Identify barriers dengue eradication of environment aspects (environment), covering both the environmental quality of the environment inside and outside the home**

Adverse public health habits and lack of attention to environmental hygiene habits such as cleaning the yard, cleaning mosquito breeding, habits reservoir to store water in a water bath, as the water reservoirs are often not washed and cleaned on a regular basis eventually become a potential breeding places of *Ae. aegypti*. According Notoatmodjo (2003) influence people's behavior on the environment because the environment is an area for the development of these behaviors. Environmental conditions that favored mosquito for perch/resting places that are dark, damp and a bit cold, also the hanging clothes.

**Category Data**

Categories of data for subjects 1 to 4

NO	CATEGORY	SUBJECTS1	SUBJECTS2	SUBJECTS3	SUBJECTS4
1	Knowledge about dengue	Good enough	Good enough	Less	Less
2	An understanding of dengue Agent	<i>Aedes aegypti</i>	Dengue Virus	Mosquitoes, but do not understand the type mosquitoes	Mosquitoes, but do not understand the type mosquitoes
3	The existence of larvae	There is water in the container, place the chicken drink, flower vases, used goods	Contained in the tub, used goods	There the water is dirty shelters	Contained in the tub
4	Participation in the eradication	The notion of participation PSN, routinely carry out	The notion of participation PSN, but not routinely carry out because of busy	Not knowing participation in the PSN	Not knowing participation in the PSN
5	The role of health workers	Health workers are less active	Health workers are less active	Do not know the role of officers	Do not know the role of officers
6	environmental factors	Environmental sanitation is important	Environmental sanitation is important	Environmental sanitation is important	Environmental sanitation is important

Categories of data for subjects 5 to 8

NO	CATEGORY	SUBJECTS5	SUBJECTS6	SUBJECTS7	SUBJECTS8
1	Knowledge about dengue	Very good	Good enough	Enough	Less
2	An understanding of dengue Agent	Dengue Virus	Aedes aegypti	Mosquitoes, but do not understand the type mosquitoes	Mosquitoes, but do not understand the type mosquitoes
3	The existence of larvae	There is water in the container, place the chicken drink, flower vases, used goods	Contained in the tub, used goods	There the water is dirty shelters	There the water is dirty shelters
4	Participation in the eradication	The notion of participation PSN, but not routinely carry out because of busy	The notion of participation PSN, routinely carry out	Not knowing participation in the PSN	Not knowing participation in the PSN
5	The role of health workers	Health workers are less active	Health workers are less active	Do not know the role of officers	Do not know the role of officers
6	environmental factors	Environmental sanitation is important	Environmental sanitation is important	Environmental sanitation is important	Environmental sanitation is important

## DISCUSSION

Based on interviews, observation and other complementary data sources and data analysis in this study can be seen that knowledge/understanding of dengue agent informants vary although most have been good. According to Green (1980), quoted from Notoatmodjo (2003) that knowledge is a predisposing factor for the occurrence of the behavior. Or cognitive domain knowledge is very important for the formation of one's actions (overt behavior) and he also said that based on the knowledge of the behavior of more enduring than behaviors that are not based on knowledge. If the respondent does not know clearly how to eradicate mosquito breeding and factors influencing the presence of larva can not take an appropriate action, so that the respondents in the larvae of *Aedes aegypti* found any.

Based on observations and interviews about the presence of mosquito larvae itself is very close to the community. The whole informant has potential places to be breeding *aedes aegypti* mosquito place. This is due to several things, among others, the mosquitoes have lived in fresh water habitats in water reservoirs around the house, inside the house such as: crock/bowl, tub, bathroom/wc, urn/vase, pot is not perforated, pedestal pot, taking place in bird cage, outside the home: rainwater drums, old tires, tin cans, broken

bottles, dishes, pots no holes, a used bucket, and so on.

In observance of the *aedes* mosquito behavior, the role of participation *masyakat* eradication need to eradicate mosquito larvae *Ae aegypti* especially in the home and environment, respectively. Public participation is intended participation in environmental quality monitoring activities. Environmental quality supervision is the most effective activities for dengue vector control, the activities that can be done through cleaning mosquito breeding (PSN). PSN aims to eradicate or prevent the mosquito larvae can not breed. This method is a way that most effectively implemented due to several considerations, among others : it does not require great expense, can be contested to be the cleanest area, the environment clean, Indonesian culture that happy life work together. With a good environment is not impossible, other diseases caused by dirty environment will be reduced. Thus an important step in the fight against dengue is via PSN activity involving the active participation of the community. The results of research into improved environmental quality in order to eradicate dengue fever in the District of Sukabumi shows that monitoring environmental quality is consistently more effective than other interventions. Decrease house index reached 13.3, the container index and Breteau index 13.4 1.0 (Sumengen, 1990).

Environmental aspects have considerable potential for the spread of dengue disease, especially in the area/region is densely populated, especially on big cities. This is because the distance to fly *Ae. aegypti* approximately 100m. In Indonesia, especially the affected areas of the city, but since 1975 it also contracted the disease in sub-urban and rural areas are densely populated and high mobility. In addition, the distance between the house also affects the spread of mosquitoes from one house to another, the closer the distance between the house mosquitoes spread more easily on either side of home. Ingredients for home, home construction, the color of the walls and setting items in the house causes the house liked or not liked by mosquitoes. Various infectious diseases research proves that housing conditions and the jostling slum has a greater likelihood of developing the disease. (Teguh, W, 2007).

#### CONCLUSIONS AND RECOMMENDATIONS

Barriers eradication of the dengue vector agent aspects, since no vaccine, dengue virus, and basically all the communities have places that allow it to become a breeding place for mosquitoes *Aedes aegypti*. The resistance of the host aspect of community participation in the PSN and the role of workers in health education has not maximal. The resistance of the aspects of environmental hygiene is not optimal environment giving rise to the risk of transmission of dengue disease transmission in the community. Suggestion need active community participation in the activities of continuous mosquito nest eradication, as well as full support from health workers.

#### References

- Aguiar, Maíra, Kooi, Bob and Stollenwerk, Nico, 2011, *Epidemiology of Dengue Fever: A Model with Temporary Cross-Immunity and Possible Secondary Infection Shows Bifurcations and Chaotic Behaviour in Wide Parameter Regions*, *Epidemiology and Infection*, Volume 3, Issue 04.
- Anonim, 2004, *Demam Berdarah di Indonesia*, dalam (<http://www.depkes.go.id/downloads/Bulletin%20Harian%2011032004.pdf>), diakses tanggal 7 Februari 2009.
- Ayyubi, S, 2008, *Status Banyumas KLB Demam Berdarah*, <http://news.okezone.com/read/2008/12/15/1/173880/1/status-banyumas-klb-demam-berdarah>, diakses tanggal 10 Februari 2009.
- Chin, J, 2006, *Manual Pemberantasan Penyakit Menular*, Edisi XVII, Cet II, Infomedika, Jakarta.
- John m. Hayes, et al, 2003, *Risk Factors For Infection During A Severe Dengue Outbreak In El Salvador In 2000*, *The American Society of Tropical Medicine and Hygiene*, Volume 69 Nomer 6, pp. 629-633.
- Hikmawati, I, Purwito, D, Setiyabudi, R, 2009, *Epidemiology Analysis of Vector Control towards Endemic Area of DHF (Dengue Haemorrhagic Fever) in Banyumas Regency*. Prosiding Seminar Internasional, *Natural Product for Cancer Chemoprevention*, ISBN 979-97761-0-4.
- Hikmawati, I, Purwito, D, Setiyabudi, R, 2009. *Model pemberdayaan masyarakat dalam upaya pencegahan kejadian luar biasa (klb) penyakit Demam berdarah dengue (dbd) di kec. Sokaraja*. LPPM Universitas Muhammadiyah Purwokerto.
- Setiyabudi R & Hikmawati I, 2006. *Kesukaan Nyamuk Aedes Aegypti Bertelur pada Kontainer Berwarna Gelap dan Kontainer Tidak Berwarna Gelap*, *Medisains*, Vol IV. No 2, Agustus 2006, Penerbit Fak. Ilmu Kesehatan Universitas Muhammadiyah Purwokerto.
- Widianto, T (2007) *Kajian manajemen lingkungan Terhadap kejadian Demam Berdarah Dengue (dbd) Di Kota Purwokerto Jawa –Tengah* Program Pasca Sarjana Universitas Diponegoro Semarang.

**RELATIONSHIP BETWEEN ANTENATAL CARE SERVICES  
AND PERINATAL MORTALITY RISK FACTORS  
IN PUBLIC HEALTH CENTER OF PALEMBANG IN 2012**

**Rosmiarti<sup>1</sup>, Enderiasari<sup>2</sup>**

lecturer, Midwifery Diploma Degree Muhammadiyah Palembang  
rosmiarti\_5474@yahoo.com/0853-69377799

**Abstract**

*Childbirth is one of the factors that influence perinatal mortality. In addition to other factors such as the deliveries performed at home with traditional personnel as birth attendants, as well as the mother condition during pregnancy are less favorable (less nutritional status, complications of pregnancy) and late referral. Service quality is a prerequisite in order to increase the use of service need to be preceded by improved medical standards through the efforts of Maternal Perinatal Audit (AMP).*

*This study aims to find out is there any relation between antenatal care services and risk factors of perinatal death in public Health Centers of Palembang City. This study is a retrospective observation of events that already exist using a case control study using primary data obtained from direct interview of the respondents who visited the public health center by using a questionnaire, as well as secondary data source that is originated nd medical records of ANC history and outcome of pregnancy and childbirth.*

*The results showed that of 180 respondents, 75% control and 25% of cases, 71.1% received unstandarized antenatal care, 80.6% was not risky age, risky parity 56.7%, 68.9% of highly educated, and 89,4% do not experience complications in pregnancy and childbirth. The result of logistic regression analysis showed significant effect between the antenatal care services jointly (simultaneously) on perinatal mortality in the city of palembang in 2012, with age variable with complications of pregnancy and childbirth as interaction variables. Respondents who received antenatal care services that unstandarized to have a risk 3.89 times for infants experiencing perinatal death when compared to respondents who receive standardized antenatal care services.*

*By knowing the relationship between antenatal care services and risk factors of perinatal death, it is recommended that adequate maternal health practices, the frequency of regular visits, service providers according to the standar (ST) remains an effort that should be improved, needs to*

*do more intensive counseling, and need consider improving the quality of antenatal care, especially for pregnant women with high risk and the risk of pregnancy and childbirth complications.*

**Keywords:** antenatal services, mortality, risk factor

**Bibliography:** 36 (1991-2010)

**INTRODUCTION  
BACKGROUND**

Welfare indicators a society characterized by Human Development Index(HDI) or commonly known as human development index (HDI), there are three sector measured in HDI namely health, education and economic. In Indonesian 2005 ranks 110 of 177 countries, with an index 0,697 this position far enough compared state the neighbouring countries such as malaysia (order 61/0,796), thailand (73/0,778), filifina (84/0,758), and vietnam (108/0,704), in 2006 indonesia has advanced with figures ipm reached 0,711 and are at the 108 defeat vietnam which is it has value.

In order the attainment of ipm one of an indicator that affect is an indicator of the health of being represented by the age of life expectancy (UHH). The age of life expectancy is an indicator of various composite The impact of health development where one of the indicators of the impact of who was very influential is infant mortality rate (IMR) and the mother mortality rate(MMR) ( wikipedia indonesia, 2004)

Infant mortality rate is one indicator sensitive to know the health of a country even to measure the progress of a nation. Infant mortality rate (IMR) by calculation indirect of 60 per 1000 susenas' (95), down to 49 per 1000 (susenas' '98), and become inflated again 51 per 1000 (susenas' ol). In 2006 (ibi) to mmr 373/100,000 IMR and 54/1,000 of live births.

In plan strategic national making pregnancy safer (mps in indonesia 2001 one of these targets is lowering maternal mortality be 125/100,000 of live births and Neonatal mortality rate per 1000 live births to 16.

Research surjono and ekawati (2001) in five hospital level in regional ii diy obtained results 42,0 perinatal mortality rate per 1000 live births. The study shows mortalitas skrt 2001 a major cause of perinatal deaths aspiksia 34%, is premature and low birth weight (33%, bblr) congenital abnormality 4% and maternal health affecting the fetus at 3%. Some infants it can cause of death dates from the 28th week of gestation until the day after childbirth perinatal (the 7th). According to susenas 2001 a major cause is death infant mortality perinatal (36%). Childbirth is one factor influencing perinatal deaths. Besides what other factors like delivery carried out at home with exertion as helper births, shamans and the conditions for pregnant mother/disadvantage (status malnutrition, complication pregnancy)

And lagging a reference. Service quality that is a prerequisite to improve the use of service need prefixed to improved medical standards through the effort to audit maternal perinatal (ampères.). Post-delivered-mothers at age more and 35 years will have problems resembling mother who is pregnant at the age of young. One on ataranya namely the increased risk stillborn and death perinatal forsass (et al, 1999). Mother who not visit service antenatal (anc) during pregnant have risk higher to lose the baby. Get pregnant mothers with care antenatal bad with the antenatal lacking and 4 times and do a pregnancy after age pregnancy above six months at risk 5.8 times experiencing childbirth preterm compared with pregnant mother conduct the antenatal good. This is possible because of pregnant women with care pregnancy Quality is not there less get information about mothers during pregnancy (dasuki dkk, 2003). Six variable demographic discovered there hubungannya with care prenatal not adekuat, age less than 20, the level of education low, low incomes, balance the height; status not married and not the white race (walsh, 2007) children have parents with education & gt; 12-year-olds have hope life higher on five years his life and linear relation exists between education parents with infant death. The level of education have leverage to death neonatal and post neonatal.menurut surjono and ekawati (2001) mother with education low increase or death perinatal. Infant mortality rate in 2008 in palembang recorded 7,43 per seribu of live births with details 129 infant death, where 78 Among them are perinatal deaths earlier namely 2007, death rate of infants 11,86 per 1,000 live births with details infant mortality, 145 where is was 110 perinatal deaths in 2006 infant mortality rate of 6.7

per 1,000 live births with details 90 cases infant death. Where 86 them are perinatal deaths (dept. palembang, in 2008. Although everythinglooks tendency the decreasing, infant mortality but in terms of mortality perinatal increase, proportions namely 60% in 2006 to 94% in 2007. Also the proportions is higher than in 2007 reached 76%. The anc the scope of services in palembang indicated indicators still low child and maternal health services. It is shown in figure scope detection rnasih low high-risk pregnant mother only 14%. Likewise -digit scope granting tablets iron for pregnant mothers Also still low that only 80%. Based on how pregnant mother anæmia yeng done in 2008 by the dept. obtained result, palembang the prevalence of prenatal anæmia menacapai 50%. In order to decrease 5-87s and perinatal deaths had been working on various kinds of other activities included in maternal and child health program (kla). Program is a kla substantially service and maintenance pregnant mothers mother bear, mother meneteki, the toddler with one goal improve the quality of health service (ri depkes 1990). One element that matters. Infant mortality is in decline providing services maintenance pregnancy adekuat and to start as early as possible. All the mothers recommended that if they conceive of visiting doctor in puskesmas (ri depkes as early as possible 1990). Things to reck prenatal gain access to health services is effective Availability of facilities service affordable oeh society. For that role puskesmas become important considering that people hope especially pregnant women to acquire service very and affordable. Meanwhile service antenatal good expected to increase the health maternal and fetal they contain that she can breed with selarnat and babies are in good health (the who 1992). Type penetitian to do is research observational. The kind of research is aimed observation in retrospective against gen. it already is. Draft research used case control study. Draft this research to see influence exposure to its past against gen. cases and control. Analysis bivariat test used in this research is test statistics chi square with = 0,05. If value probability (p value) smaller or equal to (0,005), means something The relation between variables independent with the dependent variable multivariate analysis using kind of test regression logistic.

Test Test Interaction interaction performed on variables thought to be substance there is interaction, if indeed there is no unnecessary interaction trials held (Hastono, 2006).

## DISCUSSION

1. Relations between service orphanage antenatal with death perinatal variable service orphanage antenatal after doing analysis in multivariate and selected dengan other variables fixed have leverage meaningful statistically with High have a high risk, for the reproductive system of the mother is out of power, was first birth also risky because the birth canal mother that has not been highly capable.

The incident death perinatal, where p value = 0.014 with the odds: 3.89 (95% a CI: 1,31-11,60) the value of exp (b) = 3,944 researchers argue, this research result indicates that the implementation of the standard of service antenatal contributes on the occurrence of perinatal deaths, it means a pregnant mother get the service antenatal not conforming to standards of risky the baby had 5-87s perinatal deaths.

2. Relations between the ages of a mother by the death of perinatal variable age after kinds of analyses multivariate and selection with a variable independent other still had influence meaningful statistically perinatal deaths, with an occurrence where p value = 0,001 dengan odds: 3,94 (95% a CI: 1.82-8,61), risky the result of the test interaction age by a complication it has value exp 39,962, (b) which means that the age of by a complication have a significant effect on the death of perinatal. Researchers assumed an infant that is born of a mother by the parity High risks has high for reproducing system exhaustedly, is the mother is too risky for the first birth born mother that has useful.
3. Relations between maternal mortality perinatal education with.
4. From the education variable model multivariate no bermakna relations with mortality perinatal diamati off value = 0,193, because off & gt; ; oöphorectomy. O5 and education variable mother not included partly multivariate in an analysis. The mothers in education this research was not obtained meaningful relations with 5-87s perinatal deaths. These results can be interpreted that education mother in this not be against the increasing risk factors 5-87s perinatal deaths in Palembang.
5. Relations between complication pregnancy and childbirth with perinatal deaths resulted from complications multivariate on the second variables ineraksi had links with perinatal deaths are bermakna everywhere p Value = 0,034, after the interaction between age by complications p

value = 0,003 dengan exp (b) 39,962. The acts of pregnancy and childbirth with a complication medical or obstetric influential survival factors most influential toward death perinatal from the regression analysis logistics on the model end (fit model) is variable service orphanage antenatal after conducted analysis multivariate and selected with independent variable other fixed have leverage meaningful statistically with gen. mortality perinatal, where p value = 0.014 with odds: 15.92 (95% ci: 1,31-11,60), of all this research conclusions may be drawn that service approach antenatal to adopt service standard obstetrics proved has its bob up and down against outcome perinatal form of death.

## References

- Cunningham FG, Gant NF, Leveno KJ. et al. *Williams Obstetric*. 22<sup>nd</sup> ed. New York : McGraw Hill. 2005: 93, 123-26
- Dahlan, Sopiudin, 2008, *Statistik untuk Kedokteran*. Jakarta; Salemba Medika
- Dasuki, D dan Ida, W., 1999, Faktor Resiko Morbiditas- Mortalitas Perinatal pada Presentasi Bokong, *Berita Kedokteran Masyarakat* XV (4): 171-177
- Dasuki, D., Ova, E., Anita, L., 2003, Hubungan Pelaksanaan Standar Pelayanan Antenatal Oleh Bidan di Desa Dengan Kejadian Anemia di Kabupaten Purworejo, *Berita Kedokteran Masyarakat* XIX (1): 51-59
- Depkes RI, 1996, *Pedoman Pelayanan Kesehatan Perinatal di Wilayah Kerja Puskesmas*, hal, 2, 51, Dirjen Binkesmas, Jakarta.
- Depkes RI, 2001, *Standar Pelayanan Kebidanan*, Jilid 1, Dirjen Binkesmas, Jakarta.
- Dharma, A dan Hamid., 2002, Karakteristik Bayi Berat lahir Sangat Rendah di RS Sanglah Denpasar, *Buletin Ilmun Kesehatan Anak*, vol VII (1), 3-10.
- Hacker NF, George M. *Essensial, Essensial Obstetri dan Ginekologi edisi 2*. Jakarta : Hipokrates. 2001 : 28, 304-5, 315
- Hastono, Priyo susanto. 2001. *Analisis Data*. FKM. Universitas Indonesia.
- JHPIEGO, 2004. *Panduan Pengajaran Kebidanan Fisiologi bagi Dosen Diploma III Kebidanan*. Buku ante Partum, Jakarta. Pusdiknakes
- Mochtar R. *Sinopsis Obstetri Jilid I*. Jakarta: EGC. 1998: 2, 198, 217, 427-29, 442-46
- Sulaiman, S., Djamhoer, M., Firman, F. W., 2005, *Obstetri Patologi : Ilmu Kesehatan Reproduksi*, EGC, Jakarta.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- WHO, 1992, Antenatal Care and Maternal Health, How Effective is it, *Maternal and Child epidemiology*, Unit London School of Hygienic and Tropical Medicine, London.
- WHO.2002. " Program Kesehatan anak dan Remaja 2 ".<http://www.who.or.id>, Diakses tanggal 14 April 2010
- Wikipedia Indonesia, 2010, Indeks Pembangunan Manusia. Available on Line at:[http://id.wikipedia.org/wiki/Berkas:HDImap\\_2006\\_-\\_colourblind\\_-\\_ompliant.png](http://id.wikipedia.org/wiki/Berkas:HDImap_2006_-_colourblind_-_ompliant.png) (diakses 18 Maret 2010)
- Walsh V linda, 2007, Buku ajar kebidanan komunitas, Jakarta, 2007 : 104
- Winkjosastro H. *Ilmu Kebidanan, edisi 3*. Jakarta: YBPSP. 2006: 294, 716, 723-28, 750-51, 775, 785, 808
- Winkjosastro H, *Ilmu Kebidanan, edisi 3*. Jakarta : YBPSP. 2005 : 294, 716, 723-28, 750-51, 775, 785, 808.
- Yulifah Rita, Yusnanto TJA, *Asuhan Kebidanan Komunitas*. Jakarta : Salemba Medika. 2009 : 59, 61, 63, 107



**EFFECT OF MIND BODY COMPLEMENTARY THERAPIES: LISTENING TO  
PASSAGES OF ALQUR'AN AGAINST LOWERING BLOOD PRESSURE AT  
SOCIAL INSTITUTION OF TERATAI NURSING HOMES PALEMBANG 2013**

**Trilia**

Lecturer' Nursing of Science Diploma Degree Muhammadiyah Palembang  
triliawm@yahoo.com/0813-67716274

**Abstract**

*One of the problem that occurs on elderly is a problem at cardiovascular system, including the problem of hypertension. In the treatment of hypertension, there can be in two ways, pharmacological therapy and non-pharmacological therapy. One of non-pharmacologic therapy which is an effective complementary therapy in hypertension patients is a mind-body therapy that is spiritual healing: listen to the verses of the Qur'an. This study aimed to determine the influence of mind-body complementary therapy: listen to the verses of the Qur'an to the decreasing of blood pressure in SOCIAL INSTITUTION TERATAI NURSING HOMES Palembang 2013. The research design is quantitative using pre-experimental research design, with a kind of quasi-experimental research pretest-post test with control group. Sampling was conducted with non-probability sampling method by using "purposive sampling", samples were 28 respondents for the intervention group and 28 respondents for the control. Previously, respondents' blood pressure were measured (pre-test) and then recited surah Al-Fatihah lasted 48 seconds for 5x repetition in one time therapy, after that the respondents' blood pressure were measured again (post test). The results of the study after the intervention, there was decreasing in average blood pressure of 14.29. Test Results of Independent Samples Test, the  $p$  value = 0.003 ( $p < 0.05$ ), it indicated that there was difference between blood pressure before and after a given intervention, meaning that there was significant effect from Mind-Body complementary therapy: listening to the verses of the Qur'an to decrease blood pressure.*

**Keywords:** Mind-body Complementary Therapies, hypertension and elderly

**References:** 20 (2007-2012)

**INTRODUCTION**

The problems that occur in the elderly one of which is a problem at work cardiovascular system, including the problem of hypertension.

Hypertension is a condition in which a person experiences an increase in blood pressure above normal, this may increase mortality (Ramadan, 2008). Hypertension was defined as systolic blood pressure 140 mmHg and 90 mmHg diastolic. Currently, the WHO-ISH criteria do not different blood pressure both young people and parents, because in principle, high blood pressure can cause complications to other organs is more dangerous. Along with age, almost everyone experienced an increase in blood pressure, systolic pressure continues to increase until age 80 years and diastolic pressures continue to increase until age 55-60 years, then decrease slowly or even decreased dramatically (Mubarak, 2009).

Based on data from South Sumatra Provincial Health Office 2011, the prevalence of hypertension in elderly patients in South Sumatra, namely 19 192 87 238 souls of the number of elderly people, that means about 22% of elderly with hypertension (Metropolis, 2011).

Hypertension can be prevented with weight loss, low-salt diet and soft diet, change your lifestyle, no smoking, and regular exercise. Besides hypertension can be controlled implement diet and healthy living such as, reducing salt intake, eating foods contain potassium, magnesium, and calcium, reducing alcohol, consumed fruits and vegetables, controlling cholesterol levels, adequate sleep, consuming fish oil, regular fasting, exercise regularly, reduce stress, quit smoking, and get closer to God (Susilo, 2011).

The treatment of hypertension can be handled in two ways, namely pharmacological therapy and non-pharmacological therapies. Pharmacologic therapy is a treatment that uses modern medicine, people with hypertension can never be separated from these therapies and drugs when consumed regularly will hve side effects, such as coughing, fatigue and dizziness, polyuria, fluid retention, sexual dysfunction, cardiac arrhythmias, and allergic reactions. While the non-pharmacological therapy is treatment without medication is applied to hypertension, such as traditional medicine, modern medicine, and complementary therapies.

Therefore, non-pharmacological therapy is the role of nurses to patients with hypertension as a complementary treatment (Junaidi, 2010).

Non-pharmacological therapies include the use of complementary therapies. Complementary therapy is a way of disease prevention conducted as a support to conventional medical treatment or as a treatment option other than conventional medical treatment (Argitya, 2010). One effective complementary therapies patients with hypertension is

mind-body therapies (mind-body) therapy that is spiritual healing: listen to the verses of the Qur'an (Setyoadi, 2011). Listening and reading the Qur'an can lower stress hormones, activate natural endorphins, increase feelings of relaxation and distraction from anxiety and tension, improve the system so that the body chemistry can lower blood pressure and slow breathing, heart rate, pulse rate, and brain wave activity, breathing rate deeper or slower is a very good cause calmness, control of emotions, thinking deeper and better metabolism (Yazid, 2007).

Therapy can accelerate healing religion; this has been proved by various experts as did Ahmad Al-Khadi, Director of Islamic Medicine Institute for Education and Research in Florida, United States.

Al-Quran is a complete medicine for all kinds of physical ailments, both diseases the world and the hereafter, the Qur'an is beneficial to be a drug, antidote, healer of human life issues. Reading the letter of the Qur'an is the best Al-Fatihah, because the essence of the Qur'an in surah Al-Fatihah and understanding of Al-Fatihah can reduce the level of anxiety and tension that can lower blood pressure and slow breathing, heartbeat, pulse rate, and brain activity, breathing rate deeper or slower (Al-Kaheel, 2012)

Al-Quran is a complete medicine for all types of hearing. One that will do that is by using the verses of the Qur'an to people with hypertension. This technique aims to reduce stress and anxiety by playing verses of the Qur'an tested using stimulation techniques for 10-15 minutes so it is expected to lower the tension of the brain that causes hypertension (Suhendar, 2011)

Language of the Qur'an is the miracle of all time, the beauty of the language and neatness wording can not be found in books of other Arabic. Sublime style is easy to understand but it is a hallmark of the style language Qur'an. Al-Fatihah is the most widely read letter by mankind, because Al-Fatihah should be read in every prayer (Fhatoni, 2011).

When one hears the reading of Al-Fatihah is Tartil and heard with pleasure and sincere heart, then the reading of Al-Fatihah be a positive influence on mental (Fhatoni, 2011).

Al-Qur'an has a very good effect on all organs of the body. In certain verses in the Qur'an that when there is information to the listener's brain could restore the program and giving the cells the nutrients with the right information, so that these cells can work optimally. Listening to the Qur'an resulted in a change in electrical current in the muscles, blood circulation changes, changes in heart rate and blood levels of the skin. Such changes indicate the presence of relaxation or tension reduction in fibril reflective resulted in easing the arteries and increase blood levels of the skin, accompanied by a decrease in heart rate. (O'Riordon in Hasri, 2012).

Based on the explanation above, the researcher is interested in conducting research on the influence of mind-body complementary therapies: listen to the verses of the Qur'an to the decrease in blood pressure nursing home elderly Teratai Palembang 2013.

The study aimed to determine the effect of mind-body complementary therapies: listen to the verses of the Qur'an to the decrease in blood pressure nursing home elderly Teratai Palembang 2013.

## METHODS

This study used a quantitative with *quasi experimental pretest-post test with control group*.

The shape of this design are as follows:

Group	Pretest	Intervensi	Posttest
Intervention	01	→	02
Control	03	→	04

Given intervention is a complementary mind-body therapy by listening to the Qur'an verse in elderly patients with hypertension. In the group of subjects begins by measuring blood pressure and after intervention by playing verse of Quran was measured again to determine the result of the intervention. Testing causal done by comparing the results of pre-test post-test with control group

The variable in this study consists of two variables, namely the independent variable and the dependent variable. Independent variable in this study is a complementary therapy: listening to the verses of the Qur'an and the dependent variable is a decrease in blood pressure. The variables measured in this study are the dependent variable, i.e. blood pressure before and after the intervention (Nursalam, 2009).

The population in this study was all elderly nursing home Teratai Palembang 2013.

Sampling was conducted with non probability sampling method with the technique of "purposive sampling", Number of samples 28 respondents for intervention group and 28 respondents for the control group

Data Collection Techniques performed as follows:

1. The study was conducted in the morning at 8:00 to 11:00 pm.
2. Researchers measured blood pressure treatment groups and the action of the respondents in a lying position.
3. Use Mp3 Player and researchers' pair of headphones in the treatment group and the respondents play Al-Fatihah letter duration 5x as much as 48 seconds in 1 repetition time therapy.
4. Adjust the volume used by the normal threshold of hearing clients.
5. Ask the client to relax in surah Al-Fatihah listen.
6. After the cessation of therapy (maximum 5 minutes), encourage respondents to be more relaxed and researchers measured blood pressure again respond.

This analysis began with the calculation of the frequency and the present value of each variable. For numeric data values used mean, median, and standard deviation. The results of the univariate analysis are presented in tabular form distribution, frequency and narrative

To know is there any effect of mind-body complementary therapies: Listening to Scripture Quran to decrease blood pressure by looking at the differences in the mean (average) data sets using computer programs, data analysis calculated using T test (Independent t tests)

## RESULTS AND DISCUSSION

Table 1. Frequency distribution of the age of the respondent in Nursing Home Teratai Palembang 2013

No	Age	Frequency	Persentation
1.	Middle age (45-59)	2	3,6
2.	Elderly (60-74 tahun)	37	66,0
3.	Old (75-90 tahun)	14	25,0
4.	Very old (> 90)	3	5,4
<b>Total</b>		<b>56</b>	<b>100</b>

Table 1 found that more elderly respondents i.e. 37 respondents (66%).

Tabel 2. The frequency distribution of Respondents Gender Nursing Home Teratai Palembang in 2013

No	Sex	Frequency	Persentation
1.	Male	23	41
2.	Female	33	59
<b>Total</b>		<b>56</b>	<b>100</b>

Table 2. found that more respondents with female gender that 33 respondents (59%).

Tabel 3. Systolic Blood Pressure and Diastole Respondents Before and After Listening Verses of the Qur'an Nursing Home Elderly Teratai 2013

Blood Pressure	N	Min	Max	Mean	Std Dev
Sistolik before	56	130	220	145,89	19,589
Diastolik before	56	80	120	93,30	7,878
Sistolik after	56	110	200	139,29	18,474
Diastolik after	56	70	120	89,82	8,579

\* Sources Research 2013

Based on the table. 3 systolic blood pressure obtained before granted intervention with 145.89 seen that the mean of blood pressure before the intervention given the lowest value and the highest value 130 220, from the standard deviation of systolic blood pressure before granted intervention 19.589, diastolic blood pressure before granted intervention with mean 93, 30 showed that the diastolic blood pressure before the intervention given the lowest value and highest value 80 120, the standard deviation of the results of diastolic blood pressure between 7.878 before granted intervention. While systolic blood pressure after a given intervention with 139.29 seen that the mean blood pressure after the intervention given the lowest value and the highest value 110 200, from the standard deviation of systolic blood pressure before granted intervention was 18.474.. Diastolic blood pressure after a given intervention with 89.82 seen that the mean diastolic blood pressure after intervention given the lowest value and highest value 70 120, the standard deviation of the results of diastolic blood pressure before granted intervention is 8.579).

Table 4. Analysis of Blood Pressure Decline After  
Mind Body Therapy Forum Listening Verses  
of the Qur'an Nursing Home Elderly Teratai  
Palembang 2013

Blood Pressure	N	Mean	Std Dev	T	P Value
Intervention	28	132,14	19,121	3,114	0,003
control	28	146,43	14,960		
<b>Total</b>	56				

\* Sources Research 2013

Based on the table. 4 above, the frequency distribution obtained from 28 respondents after the intervention given the mind body complementary therapies: listen to the verses Alquran 's with a mean of 132.14, while the control group with a mean of 146.43, it indicated that there was a decrease in mean blood pressure of 14.29. The results of the data analysis for the standard deviation in the intervention group were given mind body complementary therapies: listen to the verses Alquran with an 19.121 while the standard deviation for the control group was 14.960. With Test Independent Samples Test, the value value = 0.003 (<0.05)

Theses result of the hypothesis Ho is rejected and Ha accepted, thus there is a difference between the blood pressure before and after a given intervention, meaning that there are significant complementary therapies Mind-Body: listen to the verses of the Qur'an to the decrease in blood pressure.

This is consistent with the results of the study Destriani (2012) in RW 08 Sub 3-4 Ulu Palembang, there Statistically significant differences between the blood pressure before and after the intervention given value = 0.000, which means listening to verses of Al-Quran has influence effective in lowering blood pressure.

Further research was also consistent with the results of the study Permana (2010) in Yogyakarta Mergansan health centers, with a focus respondents 15 respondents to the level of pain the active phase of the first stage of labor in primiparous as the treatment group by listening to Quran verses and acquired severe pain scale before being given intervention there are 10 respondents (66.7%), and after the intervention given the number of respondents with severe pain scale was reduced to 7 respondents (46.7%). It is clear that a significant difference between the respondents before and after a given intervention by listening to the Holy Quran Verse of the pain intensity.

Hasri (2011) also conducted a study on the effects of distraction techniques: listening to the verses of the Qur'an to the intensity of postoperative pain in patients with digestive

disorders in Hospital "X" in the city of Palembang, research results showed no statistically significant difference between the intensity pain before and after a given intervention. value = 0.000, which means listening to the Holy Quran verse by the method 5x in a single repetition has the effect of therapy are effective in reducing postoperative pain intensity digestif.

This was consistent with several studies cited by O'riordon in Hasri (2012) The effect of therapy in the form of reading the Quran, the change in electric current changes in muscle, blood circulation changes, changes in heart rate and blood levels of the skin. Such changes indicate the presence of relaxation or tension reduction in fibril reflective resulted in easing the arteries and increase blood levels of the skin, accompanied by a decrease in heart rate and blood pressure drop. Murotal therapy works on the brain, which when driven by external stimuli (Quran therapy), the brain then produces chemicals called neuropeptides. This molecule will carry into receptors-their receptors in the body and will provide feedback in the form of enjoyment or comfort.

The results are consistent with the results of research conducted in the Department of Physics, State ubuntu from start to 2006-2009, which turned out to listen to the verses of the Quran have such benefits: Relieves stress and increases resistance to stress lowers blood pressure, improves relaxation, tranquility and comfort, help overcome insomnia (difficulty sleeping sickness), increasing immunity (immune system), and increase intelligence Qalbu.

The results are consistent with the results of research conducted in the Department of Physics, State ubuntu from starting in 2006 Based on the above, listen to the verses of the Qur'an is seen from the decrease in blood pressure before and after a given intervention has an effective influence on the blood pressure of elderly Nursing Home Elderly Teratai Palembang. Reading verses of the Qur'an were able to relax the nervous tension reflective, resulting in a change in electrical current in the muscles, blood circulation changes, changes in heart rate and blood pressure drop. A person who has hypertension will adapt and focuses on therapies that are heard, that the verses of the Quran by using a relaxed feeling. So the feeling of relaxation and confidence in the utility of listening to the verses of the Qur'an that would improve the system so that the body chemistry can lower blood pressure. In this case, by listening to the verses of the Qur'an serves to lower blood pressure, relieve stress, increase relaxation, anxiety and make sense of the patient to be relaxed and comfortable.

## RESUME

Based on the results of research conducted during the one and a half months on the date of May 10 to June 31 in 2013 Nursing Home Elderly Teratai Palembang it can be concluded as follows: No statistically significant differences between the blood pressure before and after the intervention given value = 0.003, which means listening to verses of the Qur'an have influence effective in lowering blood pressure.

## SUGGESTIONS

### 1. Nursing Home Elderly Teratai Palembang

Need to influence the development of mind-body complementary therapies: listening verses of Al-Quran in Indonesian is time to be given more attention. Should the results of this study can provide a picture so that patients know the method of lowering blood pressure which can be heard through the verses of the Qur'an. Nursing Home Elderly Teratai is expected to develop mind-body therapy: listening to verses of Al-Quran as one of non pharmacologic management as part of a healing process. Nursing can provide complementary therapeutic intervention mind-body: listening to verses of the Qur'an as one non farmakalogi management in hypertensive patients.

### 2. For Educational Institutions

Research on non-pharmacological management of hypertension in hypertensive patients with complementary mind-body therapies such as listening to verses of the Qur'an should be continued to be developed in science and technology.

### 3. For Educational Institutions

Research on non-pharmacological management of hypertension in Hypertensive Patients with complementary mind-body therapies such as listening to verses of the Qur'an should be continued to be developed in science and technology.

## References

- Al-Kaheel, A.D., *Pengobatan Qur'ani*, Amzah, Jakarta, 2012.
- Destriani, A. Pengaruh terapi Komplementer *Mind Body*: Mendengarkan Ayat-ayat Alqur'an Terhadap Penurunan Tekanan Darah Pada Lansia di RT 08 Kelurahan 8-9 Ulu Palembang. 2012.

- Fhatoni, A., *Sembuh Dari Berbagai Penyakit Dengan Al-Fatihah*, Mutiara Media, Yogyakarta, 2011.
- Hamid, A. Y. S., *Buku Ajar Riset Keperawatan: Konsep, Etika, & Instrumentasi*, Edisi 2, EGC, Jakarta, 2008.
- Hasri, Lia. *Pengaruh Teknik Distraksi : Mendengarkan Ayat-Ayat Al-qur'an Terhadap Intensitas Nyeri Pasca Bedah di Rumah Sakit Muhammad Hosein Palembang Tahun 2012*.
- Junaidi, Iskandar, *Hipertensi*, PT. Bhuana Ilmu Komputer, Jakarta, 2010.
- Mahmudi, A., *Dahsyatnya Berobat Dengan Al-Qur'an*, Lafal Indonesia, Yogyakarta, 2011.
- Margiyati. 2010. Pengaruh Senam Lansia terhadap Penurunan Tekanan Darah pada Lansia Penderita Hipertensi di Posyandu Lansia Ngudi Waras, Dusun Kemloko, Desa Bergas Kidul
- Metropolis, 2011, *Lansia Mengidap Hipertensi*. Dinas Komunikasi dan Informatika Palembang
- Mubarak, dkk, *Ilmu Keperawatan Komunitas*, Salemba Medika, Jakarta, 2009.
- Muntaha, I., *Sehat Cara Al-Qur'an*, Al-Maghfiroh, Jakarta, 2012.
- Musiconlinecairo. 2007. Meditasi dengan Al-Qur'an (<http://musiconlinecairo.multiply.com/journal/item/34>, diakses Oktober 2012)
- Nursalam, *Konsep Metodologi Penelitian Ilmu Keperawatan: Pedoman Skripsi, Tesis, dan Instrumen Penelitian Keperawatan*, Edisi 2, Salemba Medika, Jakarta, 2009.
- Permana, 2010. *Pengaruh Terapi Ayat-ayat Alqur'an Terhadap Nyeri Persalinan Kala I di Puskesmas Mergansan Yogyakarta*
- Potter, P. A. & Perry, A. G. (2006). *Buku Ajar Fundamental Keperawatan: Konsep, Proses, dan Praktik*. Edisi 4. Vol 2. Jakarta:EGC.
- Setiadi, *Konsep Dan Penulisan Riset Keperawatan*, Edisi 2, Graha Ilmu, Yogyakarta, 2012.
- \_\_\_\_\_, *Konsep Dan Penulisan Riset Keperawatan*, Graha Ilmu, Yogyakarta, 2007.
- Setyoadi, Kushariyati, *Terapi Modalitas Keperawatan pada Klien Psikogeriatrik*, Salemba Medika, Jakarta, 2011.
- Suhendar, Edi. 2011. Manfaat Membaca dan Mendengarkan Al-Qur'an
- Susilo Yekti, Ari Wulandari, *Hipertensi*, Andi, Yogyakarta, 2011.
- Yazid. 2007. Melihat Manfaat Membaca Al-qur'an bagi Kesehatan (<http://forum.cintarasul.co.id/viewtopic.php?t=4971&sid=b625a76d9728d3edb08bbeeb57b2e534>, diakses Oktober 2012)

## EFFECT OF DHIKR THERAPY ON LABOR PAIN KALA 1 AT MATERNITY CLINIC BUDI INDAH IN PALEMBANG IN 2012

Maya Fadlilah<sup>1</sup> and Mar'atun Ulaa<sup>2</sup>

Lecturer' Nursing of Science Diploma Degree Muhammadiyah Palembang

<sup>2</sup>www.maratunulaa@gmail.com/0819-77718383

### Abstract

*Pain in childbirthing is defined as a signal to tell the mother that she has entered the stage of the delivery process. Pain management can be conducted by means of pharmacological and non-pharmacological that is by dhikr therapy. As a Muslim, dhikr can be interpreted as a medicine and one of worship. This study was to determine the effect of dhikr therapy on labor pain Kala 1 at Budi Indah Maternity Hospital in Palembang 2013. The study design used was experimental (one group pre and post test) quantitatively. The sampling method used non-probability sampling by purposive sampling with 20 respondents. From the results, it showed the scale of pain before the intervention the lowest value was 4 and the highest value was 9. While the scale of pain after the intervention showed the lowest value was 3 and the highest value was 8. From the statistical test using the test  $p=0.000$  ( $< 0.05$ ) showed dhikr therapy had effect on labor pain Kala 1 reduction. Dhikr therapy can be used as a non-pharmacological nursing intervention to reduce labor pain Kala 1.*

**Keywords:** dhikr therapy, labor pain, kala 1

**Reference List:** 26 (2002 – 2012)

### INTRODUCTION

Delivery is a normal physiological. Give birth normally is the fetus that happened in pregnancy (37-42 Sunday), born spontaneously with the presentation behind the head that took place in 18 hours, without complication in both mother and fetus. (Wiknjosastro, 2002). Give birth normal is the process of baby with lies behind the head with power mother itself, without the help these heavy equipments and not to hurt his mother and baby, which is usually lasted 24 hours. (Mochtar, 1998 in Nurasiah 2012).

In the delivery pain is a problem that is felt by the mother, if not addressed the issue is a psychological stress, such as fear, anxiety, depression, as well as a physical fatigue. physiologically pain birth occurs when uterine muscles contract. Womb contraction cause dilatation and depletion and ischemia servik uterus

contraction ateri miometrium. Another reason lower pelvic strain gauge that caused stretching the structure birth way the bottom as a result of the decline bottom part fetus. Pain can lead to a psychological disturbed pain and pain that too much to cause worry, fear, and tense this was to encourage production of the hormone prostaglandin that arose a stressful stress can affect their ability body holding pain (judha et al, 2010)

Pain can be addressed in a holistic approach farmokologis and non-farmokologis. Farmokologis approach that could be used are analgesics, which is divided into two classifications namely non-narcotic analgesic, and analgesic narcotic drugs, the choice depends on the pain (kee and hayes, 1997). Drugs often have side effects and sometimes drugs do not have the power enterprise that is expected to be (Burroughs, 2001).

As health workers nurses role in reducing pain both secara psychological and physical can be done with the method pain management in non-farmokologi including is distraksi. Distraksi is attention diversion client to other things that can reduce pain and even a wariness toward promoting tolerance mother against pain. Distraksi can be modified is one of them with therapy recitation. animal/man and waste material. Animal Manure/man and other waste material (Moerdjoko, 2004).

Dhikr to give balance to keep the body healthy, grow calm, the feeling of patience, and gave spirit in themselves. At Surah Ar-Ra'd ayat 28 explained "remember, in the remembrance of Allah, will be calm". Imam Ibnu Qoyyim argued, "Dzikrullah is the Qur'an, which has God for His Messenger sent down, it will calm heart of those who believe, because you will not be calm except with faith and is confident. And there was no way to get their faith and confidence except by the Qur'an" (Cikli, 2010).

A Study done by Lin Deu This and Star (1970) show that people, to obey religious worship, and pray, and berdzikir likely to experience stress, anxiety and depression far smaller than non religious. While or Herrbert Benson shows that these words recitation can be one of the phrase

focus (the words that became the focus of attention) during the recovery process, anxiety patients from fear, and even physical complaints seperti headache, chest pains, and hypertension. (Sanusi, 2012).

Maternity Clinic Budi Indah is one of the Maternity Clinic a quite prominent in Palembang city with the number of the total amount delivery at the end of 2012 as many as 612 delivery. One of the Directors researchers chose Maternity Clinic Budi Indah as the place where research is give birth normally because at the clinic Deliver Outstanding Beautiful that is quite high culture and safety and filosofi Maternity Clinic Budi Indah, who give priority to safety, a complete cure, happiness and customer satisfaction is always in the faith and prayer.

From the point of view mental health, prayers and recitation contains elements *psychotherapeutic* which is effective and in-depth. Psikoreligius is not less important to psikiatrik, because it contains spiritual power, namely keruhanian to raise the confidence and optimism in-depth for healing themselves. One of the ways that can be done nurses is with spiritual values will invest to give strength or energy to adapt to stress physical and emotional pain to the main culprit in childbirth is to teach therapy of remembrance. Based on the background above, researchers are interested in doing research about The influence of pain therapy recitation birth at Kala I in the Maternity Clinic Budi Indah in 2013.

#### **The Aim of The Research**

1. Identify pain in childbirth at Kala I before were given therapy recitation in the Maternity Clinic Budi Indah Palembang.
2. Identify pain delivery at Kala I after being given therapy recitation in the Maternity Clinic Budi Indah Palembang.
3. To Identify the influence therapy recitation of pain delivery at Kala I in the Maternity Clinic Budi Indah Palembang.

#### **LITERATURE REVIEW**

##### **Understanding Delivery**

Birth is the result spending conception (fetus and placenta) which has just the moon, or nearly enough the moon, and can live outside content on the road was born or through birth way another with the assistance or without the help (strength) (Manuaba, 1998 in nurasiah 2012).

#### **Factors-Important Factor in Childbirth**

There are a number of factors that have a role in childbirth, namely:

1. Power To encourage the fetus out (*Power*)
  - a. His (Contracts the uterus)
  - b. Muscle contraction abdominal wall
  - c. Contraction diaphragm Pelvic
  - d. Tensions and the contraction
  - e. Ligamentum Rotundum
  - f. Effectiveness might encourage.
  - g. For a long time persalianan.
2. The fetus (*Passanger*)
  - a. The layout fetus
  - b. Fetal position
  - c. The presentation fetus
  - d. The layout placenta
3. Road across (*Passage*)
  - a. Size and type hip
  - b. Ability to get cervical cancer
  - c. Open
  - d. Kanalis ability vaginalis and
  - e. Introitus vagina to lengthen
4. Psychological (*The Psyche*)
  - a. Physical preparation for the baby's birth
  - b. Birth experience
  - c. To Support the nearest
  - d. Intergitas emotional.

#### **The Position**

Mother position affected adaptation anatomy and physiology delivery. Upright to give a number of advantages. Change position has advantages. Change position feel tired lost, provides a feeling comfortable, and improve circulation (melzack, in Febtria 2012).

#### **The Concept Pain**

International Association for research pain (*International association for the study of pine, IASP*) identifies pain as a tasty melting texture subjective and emotional experience that is not delightfully complicated but impeccably logical associated with tissue damage the actual or potential or felt in the events where there is a damage (Potter & Perry, 2005). Pain is the experience tasty melting texture and emotional not fun of tissue damage that the actual and potential. Was the main reason Pain one's health care to seek help (smeltzer & Bare, 2002).

#### **Pain Management Delivery**

Pain management delivery with ways:

1. The Method Farmokologis

Various agents pharmacological used as pain management. Usually can spoil your pain

used an analgesic effect, but drugs often cause side effects and sometimes drugs do not have the power enterprise that is expected to be (Burroughs, 2001).

2. Non-Farmokologis Method

Forging this pain can be done in one of them, with therapies non farmokologis. Non-farmokologis therapy is therapy without using drugs, but by providing various techniques that can at least it reduces the pain a little bit. Are as follows (Prasetyo 2010 & Judha et al 2012)

a. Distraksi

Distraksi is to focus on patients with abdominal pain, they are:

- 1) Distraksi visual, for example:  
Reading or watching television.
- 2) Distraksi auditory, for example:  
Listen to the music
- 3) Distraksi taktil, for example:  
Interesting  
Breath and massage
- 4) Distraksi cognition, for example:  
Playing puzzle

b. The method summer cold

This method can provide a comfortable, reduces muscle ache, and reduce tensions.

c. The movement

Increase blood circulation, pain back decreases, pain from teralih attention.

d. Massage

On the shoulder Massage, the neck, face, and their backs bias defusing tensions muscles and give a sense relaxed. Blood circulation also became more smoothly so painful decreases.

e. Breathing technique that is true

Focusing on breath may divert pain, to make the muscles relaxed and tension.

f. *Reflexologist*

Pressing the point at his feet to reduce pain. Massage soft at the foot also makes a convenient. THOUGHTS pain is diverted to massage.

g. *Acupressure*

*Acupressur* is development of acupuntur technique in principle, the treatment is different, depending on the type of complaints. Both are installed unique to determine the points that are in pressing to go into nervous system. If you are in the application akupuntur using a needle, with only wore the movement's finger pressure that kind of hit clip, hit titi and hit straight, *acupressur* can be done.

h. *Aromatherapy*

*Aromatherapy*/a pleasant odor- odors and give comfort and relaksi in the body and mind, pain and mother worried will be overcome, so pain will be reduced

i. *Hypno-brithing*

The method *hypno-brithing* was developed based on the belief that with the preparation gave birth to a comprehensive (*Body Mind and spirit*). this method is one of the tehknik hypnosis or suggestive implications. In face pregnancy and preparation gave birth to a functioning help the pregnant women through the spersalinannya in a way that experience, smooth, and brains trust (without pain). The method *hypno-brithing* work based on the suggestion that he felt confident that there is a pain can be reduced.

### Dhikr Therapy

Dhikr is devotional practices that can bring a reward as well as can be therapy for various diseases, both psychological diseases, such as stress, fear, anxiety, depression, as well as physical illness. Recitation is in fact remembrance of Allah SWT, both in the form orally and their hearts.(Mahfani, 2006) Dhikr, including in prayer, while prayer can be defined as recitation, remember that God. (A. Isa, 2006 ). Dhikr God healed every kind of disease in the heart. One of prophet: "In the praise of Allah is cure diseases, it means to improve heart" (Hadist from Anas bin Malik). "The Word of God, God will celebrate by your maximum that can be easily for you to get a victory" (Qur'an 8:49, 52:10) (Aziz 2006).

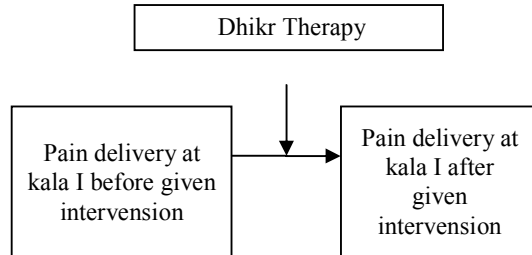
Distraksi is turned his attention to a different matter so it reduces pain, even a wariness toward tolerance to prop up pain (potter & perry, 2006). Distraksi can be modified is one of them with Dhikr Therapy. Dhikr is an activity remember, in the name of God the therapy can be made as a variety of diseases, both heart disease and psychological illness (Mahfani, 2006).

Sanusi Oxman in San francisco (2012) the United States remarked that the effectiveness and prayer recitation that was done on 393 heart patients. Respondents were divided into two groups at random. First Group therapy for prayer and recitation, while the other was not. These results show that those who get therapy to only a few experience complication. Meanwhile, the group were not given therapy to arise complications.



## RESEARCH METHOD

Draft 1. The Framework Concept  
The Influence Dhikr Therapy on of Pain Delivery  
At Kala I



This research use design quantitative with quasi eksperimental pre –post one group. The characteristic type this research is to express cause and effect relationship by involving one of the group subject. The subject observed before interventions, then observed, after being given intervention (Nursalam, 2009, notoatmodjo, 2010). Design is As follows:

Pretest	Intervention	Posttest
Paint before given intervensi	Dhikr therapy	Paint after given intervensi

### Population and Samples

#### Population

Study population is all mother inpartum that experience any pain delivery at that time I in the clinic Deliver Outstanding Beautiful Palembang.

#### Samples

Sampling techniques used is *Non-probability sampling* by using this method *purposive sampeling* technique, which is the determination samples with how to choose samples among the population and that he pleases researchers, so these characteristics can represent a population that has been done before (Notoatmodjo, 2010).

To determine sample size used the equation hypothesis test different price in pairs, in Ariawan, 1998 Febtria, 2012). Based on previous research had been found price reduction pain sensation before given intervention high pain decreased to 3.41 with the standard deviation 1.30. The difference between pain before and after the intervention 1.09 (Indrati, 2009 in Febtria 2012).

The determination of a Sample:

$$n = \frac{\partial [Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}]^2}{(\mu_1 - \mu_2)^2}$$

Note:

N : Number of Sample

$\partial$  : Standard from price in pairs or old/or earlier

$Z_{1-\alpha/2}$  : The Z to the degree trust  $1-\alpha/2$  degree Statistical significance  $\alpha$  on trial z two margin

$Z_{1-\beta}$  : The 2 respondents in the power trial power  $1-\beta$

$\mu_1$  : price on the state intervention

$\mu_2$  : price on the state after the intervention

From equations above, researchers to test the hypothesis with difference price 1.09 degrees significance 5% ( $z_{1-\alpha/2} = 2.58$ ) with strength tests 95 percent. ( $Z_{1-\beta}$  or z 95 percent = 1.64) then the number of sample that had been found are:

$$N = \frac{1.30 \times [2.58 + 1.64]^2}{(3.41 - 4.50)^2} = 20$$

Based on calculations equations above, by sample as many as 20 respondents. This Research carried out in May-June at the clinic Deliver Outstanding Beautiful Palembang.

### Instrument Data Collection

Respondents data obtained by interviews and observations directly to respondents, data subject researchers is that the patients give birth at that time I in the clinic Deliver Outstanding Beautiful Palembang in 2013. Instrument which is used for data collection on researchers are as follows:

- List of questions about the identity respondents.
- Becomes Measuring pain by using *Numeric rating scale* with the 0-10, respondents only shows the value in accordance with pain that he felt.
- Note that contains recitation debt and Al-Anbiya': verse 87 in language Arab and Indonesia.

## RESULTS OF RESEARCH

### Univariat Analysis

#### 1. Frequency Distribution Respondents According to Age and Paritas

Table 1. Spread Data Age Respondents at Maternity Clinic Budi Indah in Palembang In 2013

Variable	Mean	Median	SD	Min-Max	95% CI
Age	28.95	28.50	4.751	20 - 39	26.73 -31.17

Of the table 1 in the above, obtained by average age distribution is 28.95 (95% CI, 26.73 - 31.17), median 28.50 with the standard deviation 4.751. Low 20 years old and the highest 39 years. From the result of the estimation interval can be concluded that 95 percent are believed to be that on average age is in between 26.73 to 31.17 years.

#### 2. Distribution Data Paritas Respondents

Table 2. Paritas Respondents at Maternity Clinic Budi Indah in Palembang in 2013

Parity	Frequency	(%)
Primipara	5	25%
Multipara	15	75%
Total	20	100%

Based on the table 2 frequency distribution above, from the 20 respondents 15 respondents (75%) with paritas multipara.

#### 3. Becomes differences pain before and after therapy recitation.

Table 3. The Spread Pain Scale Before and After Being Given Dhikr Therapy in The Maternity Clinic Budi Indah in Palembang in 2013

Variable	Mn	Md	SD	Sun-max	95% CI
Pain before intervensi	6.35	6.00	1.663	4 - 9	5.57 - 7.13
Pain after intervensi	4.95	5.00	1.669	3 - 8	4.17 - 5.73

From the result table 3 distribution in the above, obtained by becomes distribution pain price before given intervention is 6.35 (95% CI, 5.57-7.13), median 6.00 with the standard deviation 1.663. Pain becomes lowest before given intervention is 4 and the highest 9. From the result of the estimation interval can be concluded that 95 percent are believed to be that on average scale pain is in between 5.57 to 7.13.

While average scale pain after being given intervention is 4.95 (95% CI, 4.17 - 5.73), median 5.00 with the standard deviation 1.669. Pain becomes lowest after being given intervention is 3 and the highest is 8. From the result of the estimation interval can be concluded that 95 percent are believed to be that on average scale pain is in between 4.17 to 5.73.

### Bivariat Analysis

Table 4. The Difference Average Pain Before and After Given Dhikr Therapy in The Maternity Clinic Budi Indah in Palembang in 2013

Variable	Mn	SD	SE	P value	N
Pain childbirthing kala I:					
• Before intervensi	6.35	1.663	0.372	0.000	20
• After intervensi	4.95	1.669	0.373		

Of the table 5.4 distribution price scale pain based on first measurement before given intervention and the measurement of both after being given intervention. Average scale interfered with pain before is 6.35 with the standard deviation 1.663. After interfered with becomes obtained average pain is 4.95 with the standard deviation 1.669. The difference can be seen tatoo before

interfered with and after interfered with is 1.40 with the standard deviation 0.503. Test result statistics provided by the  $p = 0.000$  so it can be concluded that there is a big difference between becomes significant pain before interfered with pain after interfered with scale

## DISCUSSION

According to Levine (1996) in Hawari (2001) from Eastern Virginia Medical School, doing research on effectiveness for prayer and remembrance on heart patients as a result shows that they get therapy and prayers are very few, it turned out that remembrance complications in heart disease.

Hamid (2000), at the time stress and anxiety individuals will be looking for support from his religious beliefs, this support is needed, remembrance and prayers and help to meet the need for a spiritual is also a protection against the body.

At Surah Ar-Ra'd verse 28 in the remembrance explained "Remember God, will be calm". The Priest Bin Qoyyim argued, "Dzikrullah is the Qur'an that has Allah sent to His Messenger, it will calm hearts of those who believe, because you will not be calm except with faith and yakin. and there was no way to get their faith and confidence except by the Qur'an".

Based on analysis researchers, remembrance had a profound influence effective in reducing pain. Remembrance of Allah will help secrete the secreting endorphins that exists in the body that can prevent gaining knowledge pain delivery at that time I. In addition, remembrance can also be expanded again diameter the wall of the blood vessels that reduced the pain, so the oxygen and glucose in the blood stream to smoothly.

## CONCLUSION AND SUGGESTION

### Conclusion

Based on the results of research in May and June 2013 at the clinic Deliver Outstanding Beautiful Palembang as many as 20 respondents it can be concluded: The influence signifikan means There is some pain delivery at that time I before and after being given intervention with  $p$  value = 0.000.

### Suggestion

#### 1. For at Maternity Clinic Budi Indah in Palembang in 2012

In order To be able to apply pain management nonfarmakologi that is part of the process nursing interventions in a way to apply pain management with technical distraksi namely therapy of remembrance for reducing pain delivery that at the same time bringing the values of islam.

#### 2. For Insitituti Education

It suggests that can be incorporated into the GBPP (An outline of The process of

learning) non-pharmacological therapy material on one of them with therapy gatherings as part of the material courses basic nursing and nursing maternity

#### 3. For Further research

It needs to be done further research therapy with the influence of remembrance for a long time to give birth normally.

## References

- Asri H, Dwi and Cristine Clervo P. (2012) *Service Delivery Normal*. Yogyakarta : Nuha Medika
- Asrinah, et al. (2010). *Service obstetric patients in the unborn child*. Yogyakarta: graham knowledge
- Aziz. (2006). *Step Tasawwuf Purity*. Surabaya: Light Shines
- Perry & Bobak (2004). *Lesson Book nursing maternitas*. Jakarta: EGC
- Brunner & Suddarth. (2002). *Lesson Book Nursing Medical surgery Edition 8*. Jakarta : EGC
- Cikli (2010). *The meaning recitation in the Qur'an*.  
[Http://www.al-qur'an-indonesia.com/web/Qur'an/listingsto/details/13/20](http://www.al-qur'an-indonesia.com/web/Qur'an/listingsto/details/13/20). Accessed on November 22, 2012.
- Darwanti, et al (2007), Spiritual Direction and Its Effects on Experienced high Anxiety In the Mother Primigravida With Birth At That time I in the General Hospital in the Journal Banyumas Nursing Soedirman, Volume 2, No. 1
- Diponegoro, et al (2009), *influence support her husband to give birth for a long time ago II In the Mother Primipara* in humanity, Vol. VI No. 2
- El-Kaysi F. (2012) *Treatment with prayer recitation and Ruqyah*. Cilacap : Pearls Media
- Febtria M (2012) – "The effect therapy to listen to verse of the Qur'an to pain delivery at that time I in IRNA Obstetric Hospital Palembang Muhammadiyah". Bachelor Theses PSIK Radiologist Palembang Muhammadiyah.
- Hasri L. (2012) - The effect Distraksi: Hears verse of the Qur'an to The intensity Pain pascabedah Digestif In IRNA Surgeon Dr. Mohammad Hoesien Palembang". S kripsi PSIK Radiologist Palembang Muhammadiyah.
- Isa. (2006). *Prayers to elect*. Jakarta: Wisdom
- Judha et al. (2012). *Theory Measuring Pain & Pain Delivery* : Yogyakarta, Nuha Medika
- K. Deswani. *Nursing Maternitas*. Jakarta 2010
- Mahfani (2006). *The merit of invocation and recitation*. Jakarta: rev. media

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Maimunah (2010), *influence training Focus with Recitation to overcome Anxiety for pregnant women First*, Bachelor Theses Psychology Faculty at Gadjah Mada University in Yogyakarta
- Nor syamsuddin. (2008) *terrible invocation of the prophets*. Jakarta: rev. medika
- [Http://books.google.co.id/books?id=kpnztpumiwc&pg=pt305&dq=doa+nabi+yunus+ketika+berada+di+dalam+perut+ikan+paus&hl=id](http://books.google.co.id/books?id=kpnztpumiwc&pg=pt305&dq=doa+nabi+yunus+ketika+berada+di+dalam+perut+ikan+paus&hl=id). Accessed on December 18, 2012
- Notoadmodjo,s. (2010) *Metedeologi Health Research*. Jakarta: Rineka reserved
- Nurasiah Ai et al. (2012)*Service Delivery Quite Normal For Midwives*. Bandung: Refika-Aditama
- Nursalam. (2009). *The concept Metedeologi Science Research Nursing: guidelines bachelor theses, Testis, and Instrument or Nursing*. Editions. Jakarta: Salemba Medilka
- Potter & Perry. (2005). *Theory Measuring pain and pain delivery*. Yogyakarta
- Potter Perry, (2006). *Lesson Book fundamentals Nursing: the concept, the process, and good edition 4.vol 2*.Jakarta EGC.
- Prastyo, (2010). *The concept and process Nursing Pain*.Yogyakarta: Graha Knowledge.
- Sanusi M. (2012) *Various Health therapy through these devotional practices*.Yogyakarta : Zahra
- Setiadi. (2007). *The concept and Writing Research Nursing*. Yogyakarta : Graha Knowledge.
- Sunarto A. (2007) *Pearls Hadist Sahih Muslim*. Surabaya: The paper Agung
- Tamsuri, A. (2007). *The concept and pain management*. Jakarta:EGC.
- Ujiniatyas.(2009). *Nursing Service delivery normal*.Jakarta: Salemba medika.
- Wiknjosastro. (2002). *Nursing Maternitas*. Jakarta 2010: Salemba Medika.

## ETHANOL EXTRACT OF BINAHONG LEAVES EFFECT (*Anredera cordifolia* (Ten.) Steen) ON HEMATOLOGICAL CHANGES IN FEMALE WISTAR RATS

Silma Kaffah<sup>1</sup>, Fitri Kurniwati<sup>1</sup>, Anjar Mahardian Kusuma<sup>1</sup>,  
Asmiyenti Djaliasrin Djali<sup>2</sup>

<sup>1</sup>Laboratory of Pharmacology-Toxicology, Faculty of Pharmacy, University of Muhammadiyah Purwokerto

<sup>2</sup>Laboratory of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Muhammadiyah Purwokerto

Correspondence: anjarmahardian@ump.ac.id

### Abstract

*Binahong (Anredera cordifolia(Teen.)Steen) is one of the plant that can be used for several diseases. This research has been conducted which explore the effect of ethanol extract of binahong leaves (Anredera cordifolia (Ten.)Steen) on hematological changes in female wistar rats. Animal tests are selected using a complete randomized block design, which is the test animals were randomly selected and have the same opportunity to be treated. Sighting study were conducted to determine the dose used in the main study. Doses used in the sighting study was 300 mg/kg and 2000 mg/kg, in this test there is no death in animal test trials. Animal test divided into 2 groups: the treatment and the control group. Each group consisted of 5 animals tested, which is the treatment group was given a dose of 2000 mg/kg and the control group was given distilled water. results analysis Independent T test show that ethanol extract of binahong leaves did not affect the value of hematological (erythrocytes,leukocytes). On the other hand the results analysis used Dependent T test show that there is changes in the number of hematological (erythrocytes and leukocytes) in the treatment group on D-1 versus D+1, D-1 versus D+7 and D-1 versus D+14. That different might not by administration of test preparation, because the control group also show changes the number of erythrocytes and leukocytes at the same time measurement.*

**Keywords:** *hematology, ethanol extract, binahong leaves (Anredera cordifolia(Teen.)Steen), white female rats*

### INTRODUCTION

Binahong Leaves (*Anredera cordifolia*) is one of the plant which can be used as medicine. According to Manoi, the benefits of binahong leaves can be used to a cure several diseases such as

for burns treatment, typhoid disease, colitis, thrush, vaginal discharge, swelling of the liver, heart swelling, increase vitality and endurance (Manoi, 2009). Binahong leaves have several active substances, such as 8.96% total flavonoids (Depkes RI, 2011), an alkaloid (betanidin) (Titis, 2013), phenolic acids (kumarat acid) (Ekaviantiwi, *et al*, 2011) and saponins (28,14±0.22). Ethanol extract of binahong leaves at dose of 50, 100 and 200 mg/kgBW can reduce levels of creatine, thereby improving renal failure (Sukandar,*et al.*, 2010), in addition at 4.25 mmol/100g (fresh) and 3.68 mmol/100g (dried) binahong leaves has antioxidant activity (Selawa, *et al*, 2013), Hermila also reported in the Kill minimum levels (KBM) at 40% ethanol extract of binahong leaves has antifungal activity to *Candida albicans* (Hermila, 2011). Activities of binahong leaves has been reported in many times, but the scientific information about dosage and safety of ethanol extract of leaves binahong was not reported yet. Hematology and blood biochemistry Observation is a part of the oral toxicity test according to OECD method. Therefore, researchers interested in studying hematological changes from animals test after oral administration ethanol extract of binahong leaves.

### MATERIALS AND METHODS

#### Materials

Materials used in this study is binahong leaf extract ethanol, 70% ethanol, distilled water, rats food, EDTA, turk reagent, hayem reagent.

#### Instrument

Instrument used in this study is a test animal cages, gloves, drink bottles, glass instrument (pyrex), vacuum evaporator, water bath, hemacytometer (ASSISTENT Germany), (eppendorf), micropipette, analytical balance (Shimadzu), syringe injection of 1 ml and 5 ml oral syringe with a sensitivity of 0.1 ml, stop watch, electric microscope (Olympus).

### The study design

Design of the study is a randomized block design, which is the test animals were randomly selected and have the same opportunity to be treated.

### Step of research

Extracts preparation. Binahong leaf samples were taken from the garden of Medicinal Plants Faculty of Pharmacy, University of Muhammadiyah Purwokerto, Banyumas, Central Java Province. Binahong leaves that have been obtained, washed, drained with aerated and performed followed by drying in the oven at 40°C until dry. Binahong powdered leaves with engine extracts were calculated using remaseration (repeated immersion). Binahong leaf powder was soaked in 70% ethanol with comparison 1:10 (BPOM, 2004). White female rat Wistar strain were used as the animal in this research.

### The design of dosage and course of study

Based on Acute Oral Toxicity Organization for Economic Co-operation and Development (OECD) Guidelines For Chemical Testing of number 420, the dose used is based on research Sighting Study 5 mg/kg, 50 mg/kg, 300 mg/kg and 2000 mg/kg (Anonymous, 2001).

### The course of study

#### 1. Sighting study

In the observations test ethanol extract of leaf binahong to rats started from dose 300 mg/kg orally, then the observed toxic effects for 30 minutes followed every hour up to 8 hours during the first 24 hours. If the test animals showed no symptoms of toxic effects, do the next dose is 2000 mg/kgBW orally to rats and

observed another rats like procedure at dose 300 mg /kgBW.

#### 2. Main study

Animals Test were divided into 2 groups, control group and the treatment group. Each group consisted of 5 rats. The treatment group was given 2 ml ethanol Extract of binahong leaf 2000 mg/ml. During test period all rats are given food and water each 2000 mg and 2000 ml of water for 1 week.

#### 3. Hematological analysis

Hematological analyzes were performed using Hemacytometer. Blood taken from the vein rats tail. Blood inserted into a test tube along with EDTA. The measured Parameter were white blood cells and red blood cells. Erythrocyte counting: 5 µL of blood was mixed with EDTA, added with 1000 µL hayem reagent, then dropped into the room count, and wait 2 minutes.

The number of erythrocytes per mm<sup>3</sup>=number of erythrocytes in 5 small field of x 10000. Counting the number of white blood cells: 10 µL of blood was mixed with EDTA, added with 200 µL Turk reagent, then dropped into count room, and wait 2 minutes. Leukocytes counting: the number of leukocyte per mm<sup>3</sup>=amount of leukocytes in the 4 field x 50 field.

## RESULT AND DISCUSSION

Observations of acute toxicity test was conducted for 14 days and the observations showed no mortality was found in rats.

Table1. Hematology measurements in the treatment group and the control group, values shown are average values ± standard deviation, P> 0.05 which means that there are no significant differences in hematological values between the control group to the treatment group

Hematological Parameters	D-1	D+1	D+7	D+14
Erythrocyte				
treatment (10 <sup>6</sup> /mm <sup>3</sup> )	8.02±1.03	8.08±2.93	14.56±5.88	7.36±1.43
control (10 <sup>6</sup> /mm <sup>3</sup> )	7.93±1.63	10.16±2.39	16.06±7.18	6.40±2.46
P value	0.921	0.254	0.727	0.473
Leukocyte				
treatment (10 <sup>3</sup> /mm <sup>3</sup> )	4.52±1.645	7.62±1.071	8.07±1236.2	7.93±1150.8
control (10 <sup>3</sup> /mm <sup>3</sup> )	5.36±0.552	7.71±0.855	8.60±1200.00	7.680±1242.2
P value	0.897	0.330	0.365	0.078

In Table 1. mean number of erythrocytes on D-1 and D+1 each treatment group and control group were was 7.93x10<sup>6</sup> and 10.16x10<sup>6</sup>, by Anonymous in 2010 that the number of normal rat erythrocytes ranged 7x10<sup>6</sup>-13x10<sup>6</sup>/mm<sup>3</sup> (Anonymous, 2010). In treatment group, the number of erythrocytes in D+1 was increased and

D+14 was decreased, it is also common in the control group. Generally, the results of the analysis of unpaired T there were no differences mean number of erythrocytes significantly between the control group and the treatment group (P> 0.05) in D-1, D+1, D+7 and D+14. Also in D-1 mean value of leukocytes amount for each treatment and

control groups were  $4.52 \pm 1.645$  and  $5.36 \pm 0.551$  which is still the normal range for adult rats ie 5000-12000/mm<sup>3</sup> (Anonymous, 2010). In D+1, D+7, and D+14 in the treatment group and the control group there is an increasing number of leukocytes, but the change of leukocytes is still within the normal range. The Changes of a leukocyte amount can be influenced by physiological or pathological state. the physiology Influence can be muscle activity, fear arousal and emotional disturbance. While the effect of pathological stimuli could be a disease (Ganong, 1999). analysis results of the unpaired t test showed no difference leukocyte number between treatment and control group ( $P > 0.05$ ) in D-1, D+1, D+7 and D+14. From the analysis, it can be concluded that the change of leukocytes and erythrocytes amount in treatment group was not caused by the ethanol extract of binahong leaves, because the control group showed similar changes as in the treatment group. Dependent T Test analysis was also conducted to determine the hematologic changes in each treatment by comparing the D-1 versus D+1, D-1 versus D+7 and D-1 versus D+14. The results of this analysis indicate the number of erythrocytes in the D-1 versus D+1 and D-1 versus D+14 not change significantly, but in D-1 versus D+7 there are significant changes in hematological values ( $P > 0.05$ ). In D-1 versus D+1, D-1 versus D+7 and D-1 versus D+14 there were a significant change in the leukocytes number ( $P < 0.05$ ), decline and increase in the number of erythrocytes and leukocytes occurs not only in the treatment group but in the control group also showed the same thing, so it can be concluded that the change is not due to the effect of ethanol extract of binahong leaves but allegedly due to the influence of the un controlled environment.

## CONCLUSION

Results of this research showed that ethanol extract of binahong leaf did not affect changes in hematology rats. The results of the analysis of independent T test showed there was no change in the number of hematological (erythrocytes and leukocytes) are significant in the treatment and control group. However, the analysis using Dependent T test showed a change in the number of hematological (erythrocytes and leukocytes) in the treatment group D-1 versus D+1, D-1 versus D+7 D-1 versus D+14. It is not due administration of test preparation but because control group also has the same erythrocytes and leukocytes amount changes for each measurement.

## References

- Anonim, 2010, Cell Differential Assessments of Peripheral Blood Films, Cold Spring Harbor Laboratory Press.
- Depkes RI, 2011, *Farmakope Herbal Indonesia*, Edisi I, Jakarta: Kementrian kesehatan RI
- Ekaviantiwi, T. A., Fachriyah, E., Kusrini, D., 2011, *Identifikasi Asam Fenolat Dari Ekstrak Etanol Daun Binahong (Anredera Cordifolia (Ten.) Steennis) Dan Uji Aktivitas Antioksidasi*, Chem Info 1(1):283–293, 2013, Laboratorium Kimia Organik Jurusan Kimia Universitas Diponegoro.
- Ganong, W.F., 1999, Review of Medical Physiology. Terj. Adji Dharma. Fisiologi Kedokteran. Edisi ke-17. EGC. Jakarta: Penerbit Buku Kedokteran.
- Girindra.A., 1986, *Patologi Klinik Veteriner*. Bogor: PAU IPB.
- Hermila, 2011. *Uji Aktivitas Antifungi Ekstrak Etanol Daun Binahong (Anredera cordifolia (Tenore) Steen.) terhadap Candida albicans Beserta Profil Kromatografi lapis Tipis, Skripsi*, Fakultas Farmasi Universitas Ahmad Dahlan, Yogyakarta.
- Manoi, 2009, *Binahong Sebagai Obat*, WARTA Penelitian dan Pengembangan Tanaman Industri 15(1) Pusat Penelitian dan Pengembangan Perkebunan, Yogyakarta, diakses 14 Desember 2010.
- (OECD) *Organization for Economic Cooperation and Development Guidelines*, 2001, Guidelines for Testing of Chemicals: Acute Oral Toxicity- Fixed Dose Procedure 420.
- Orbayinah S, Kartyanto A., 2008, *Efikasi Binahong (Anredera cordifolia (Tenore) Steenis) terhadap Kadar Alkaline Phosphatase*, Fakultas Kedokteran Universitas Muhammadiyah Yogyakarta.
- Titis, M.B.M., Fachriyah, E., Kusrini D., 2013, *Isolasi, Identifikasi dan Uji Aktifitas Senyawa Alkaloid Daun Binahong (Anredera cordifolia (Tenore) Steenis)*, Chem Info 1(1):196-2010
- Sukandar, EY., Qowiyyah, A., Minah, N., 2010, *Pengaruh Ekstrak Etanol Daun Binahong (Anredera cordifolia (Ten.) Steenis) pada Model Tikus Gagal Ginjal*. JMP; 2010.1(2)
- Selawa, W., Revolta, M.J.R., Citraningtyas, G., 2013, *Kandungan Flavonoid Dan Kapasitas Antioksidan Total Ekstrak Etanol Daun Binahong Anredera Cordifolia (Ten.) Steenis.*, Jurnal Ilmiah Farmasi – UNSRAT 2(01) ISSN 2302 – 2493

## THE COMPARISON OF FREE RADICALS SCAVENGING ABILITIES BETWEEN ETHANOL EXTRACTS OF PURWOCENG (*Pimpinella pruatjan* Molk.) HERBS AND LEAVES

Balqis Hisyam Saleh Basleman, Wiranti Sri Rahayu, Retno Wahyuningrum  
Pharmacy Faculty of Muhammadiyah University of Purwokerto

### Abstract

*Flavonoids and tannins are potentially as free radicals scavenger. Purwoceng has some of the compounds such as flavonoid, glycosides, and tannins. Research done by using DPPH and Nitric oxide (NO<sup>•</sup>) radicals. The treatment of ethanol extracts of purwoceng leaves with the scavenging activity of radical DPPH 38,65 ppm and NO<sup>•</sup> 14,73 ppm results IC<sub>50</sub> smaller when compared with the ethanol extract of purwoceng herbs by the scavenging activity of radical DPPH 57,25 ppm and NO<sup>•</sup> 28,88 ppm. The free radicals scavenging abilities of ethanol extracts of purwoceng leaves better than free radicals scavenging abilities of ethanol extracts of purwoceng herbs.*

**Keywords:** free radicals, Purwoceng, DPPH, nitric oxide

### INTRODUCTION

Free radicals is an atom or group of atoms that has a highly reactive characteristic caused by the presence of one or more free electrons or electrons are not paired, so that it becomes unstable and high-energy (Fessenden and Fessenden, 1982). To avoid the free radicals attack, is by consuming natural antioxidants in sufficient amount each day. Anti-free radical is a compound which in a small amount when compared with the substratum is capable of delaying or preventing or avoiding the oxidation of substrates which are easily oxidized (Halliwell and Gutteridge, 2000).

Flavonoids are natural phenolic compounds are potentially as free radicals scavenger and have bioactivities as a medication. Generally, leaf, root, stem and flower are the part of plant that save many flavonoids as secondary metabolites (Waji et al, 2009). Another natural phenolic compounds that potential as a free radicals scavenger is tannin. Tannins can be found in all parts of the plant, but at some plants, tannin concentrated on specific parts (Hernawan and Setyawan, 2003). One of the plants that contain flavonoids and tannins as secondary metabolites is purwoceng (Haryono, 2013).

Purwoceng (*Pimpinella pruatjan* Molk.) is a medicinal plant. Commercially, purwoceng's root

has been widely reported have medicinal properties as aphrodisiac, diuretic, and tonic. This plant is native plant from Indonesia which live in endemic areas, such as mountainous Dieng plateau in Central Java, mount Pangrango, West Java and East Java's mountainous areas.

According to Caropeboka and Lubis (1975), root extract of purwoceng motor activity, which heightens tonus striated muscles, stimulates central nervous arrangement with capture point work on the medulla oblongata, sexual behavior and to improve male mice (Caropeboka et al., 1979 in S. Usmiati and S. Yuliana, 2010). So it is said that purwoceng's root extract has an androgenic activity in mice.

Saponin group is the one of chemical compound as secondary metabolites in purwoceng plant. There are also triterpenoid-steroids, sitosterol, and stigmasterol compounds. Purwoceng plant also contains coumarin, alkaloids, flavonoids, glycosides, and tannins. By looking at the content of secondary metabolites of purwoceng plant which are flavonoids and tannins (Haryono, 2013), is needful to do more researchs to find out the potential of the power of free radicals scavenging of purwoceng plant either the leaves or herbs because for specific flavonoid compounds are concentrated in the leaves (the herb Information, 2012; Waji et al, 2009).

### RESEARCH METHODS

#### Tool

The tools used in this research include: glass tools (measuring flask, measuring cup, test tubes, erlenmeyer flask), micro pipette, Ultrasonic bath, Rotary Evaporator, analytic scales, maceration, cupboard dryer, exicator, UV-Vis Spectrophotometer.

#### Materials

##### 1. Material Test

Ethanol extracts of purwoceng herbs and ethanol extracts leaves (*Pimpinella pruatjan* Molk.).



## 2. Chemicals

Ethyl acetate technical degrees, petroleum ether technical degrees, ethanol 96% technical degrees, ethanol p.a., DPPH, sodium nitroprusside, sulfanilic acid p.a., glacial acetic acid p.a., N-(1-Naphthyl)-ethylenediamine dihydrochloride, Griess reagent p.a., BHT (*butylatedhydroxytoluene*), quercetin.

### a. Preparation of Test Materials

#### 1) Preparation of simplicia

Cultivation purwoceng plants is obtained from Dieng's farmer, Wonosobo, Central Java. Purwoceng plants that have been obtained are cleaned from impurities attached to later washed until clean. The plant had been dried with dryer cupboard. Further divided two groups that is group with the herbs and group with the leaves only. Then powdered and sifted with fine powder 20 degrees so that the obtained powders with a uniform size (anonymous, 1979).

#### 2) Extraction of simplicia

The dry simplicia powder was added to the container maceration. Done-with use 3 concentrate solution of maceration, namely petroleum ether (PE), ethyl acetate (EA) and ethanol 96%. Each maceration with a different concentrate performed as many as 3x24 hours in order to obtain optimal results maceration. During submersion, stirring for 1 hour was done so that the compounds contained in the simpilisia of purwoceng leaves and herbs can dissolve properly.

### b. Determining Free Radicals Scavenging Quantitatively with DPPH Radicals

#### 1) Preparation of DPPH solution 0,4 mM

DPPH solution of 0.4 mM is made by dissolving 15.8 mg powder DPPH in methanol p.a. on pumpkin measures 100.0 mL, then vortex.

#### 2) Determination of Maximum Wavelength of DPPH Solution

Determination of the maximum wavelength of DPPH 0,4 mM are used in the power of free radicals scavenging test is done as follows: 1000 µL DPPH solution 0,4 mm added to the volume with methanol 5 mL then observed the absorbance in the range of wavelength 400-800 nm using methanol p.a. as blank.

#### 3) Preparation of Ethanol Extract of Purwoceng

Ethanol extracts of purwoceng leaves and ethanol extracts of purwoceng herbs dissolved in methanol p.a. with a concentration of 0.01% w/v.

#### 4) Test Power Free Radicals Scavenging

As many as 1000 µL DPPH 0.4 mM put in pumpkin measures, added by the test solution with different volume series (500, 1000, 1500, 2000 and 2500 µL) is then added methanol p.a. up to 5.0 mL volume, vortex for 1 minute until the mixture is homogenous. After 30 minutes, the absorbance is measure at a maximum wavelength. Measure the negative control absorbance also without the addition of the test solution.

The magnitude of resource free radicals scavenging is calculated using the formula:

$$\text{Resource free radicals scavenging } (\%) = \frac{(\text{Abs. Control} - \text{Abs. Sample})}{\text{Abs. Control}} \times 100\%$$

The acquired absorbance data was created a linear regression equation which expressing the relationship between the concentration of the test substance (x) with the average antioxidant activity (y) of a series of measurements of replication so retrieved IC<sub>50</sub> value, is the test solution that necessary scavenge 50% of DPPH radical over the past 30 minutes (operating time), or pause time required by the test solution to reduce the radical DPPH perfectly. After 30 minutes the absorbance obtained will be constant.

### c. Determining Free Radicals Scavenging Quantitatively with Nitric Oxide Radicals (NO<sup>•</sup>)

#### 1) Making a solution of Sodium Nitroprusside 10 mM

Dissolve 299,12 mg of the powder of sodium nitroprusside in methanol p.a. on pumpkin measures 100,0/250 mL, then divorteks.

#### 2) Griess Reagent Creation

By dissolving 1,0 mL of reagent 0.33% sulfanilat acid in glacial acetic acid (20%), then incubated for 5 minutes at room temperature. Then add 1.0 mL of N-(1-Naphthyl)- ethylenediamine dihydrochloride 0.1% (w/v).

3) Determination of Maximum Wavelength  
Sodium Nitroprusid 10 mM

Determination of the maximum wavelength of Sodium Nitroprusside 10 mM used in the power of free radicals scavenging test is done as follows: 2000 µL sodium nitroprusside solution 10 mM added with 500 mL of 7.4 pH phosphate buffer and proceed with incubation at a temperature of 25°C for 150 minutes, then added with 500 µL Griess reagent and measured the absorbance in the range of wavelength 400-800 nm using methanol p.a. as blank.

4) Determination of Operating Time of  
Coupling Compound

Determination of operating time of coupling compound was done by measuring the mixture of 2000 µL sodium nitroprusside 10 mM and 500 µL phosphate buffer (pH 7.4) and the Griess reagent. Then measure the operating time mixture solution at a maximum wavelength by using methanol p.a. as blank.

5) Preparation of Ethanol Extract of  
Purwoceng

Ethanol extracts of purwoceng leaves and ethanol extracts of purwoceng herbs dissolved in methanol p.a. with a concentration of 0.01% w/v.

6) Test Power Free Radicals Scavenging

2.0 mL solution of sodium nitroprusside 10 mM added with 500 µL phosphate buffer (pH 7.4) and added a test solution with different volume series (500, 1000, 1500, 2000 and 2500 µL) then added methanol p.a. up to 5.0 mL volume, followed by incubation at a temperature of 25°C for 150 minutes. Added by 500 µL Griess reagent and incubated at room temperatures during the operating time. Read absorbance at a maximum wavelength.

**d. Preparation of Positive Control Solution**

1) BHT Stock Solution 100 ppm

The stock solution is made by weighing carefully 0,01 grams of BHT and dissolved in 100 mL of methanol p.a.

2) Quercetin Stock solution 100 ppm

The stock solution is made by weighing carefully 0,01 grams of quercetin and dissolved in 100 mL of methanol p.a.

3) Test Power Free Radicals Scavenging

The power free radicals scavenging test for a positive control is carried out with the power free radical scavenging test of ethanol extract of herbs ethanol extract leaves purwoceng, but the series volume control that is added is different. For BHT the volume series are 25, 50, 100, 200 and 400 µL of a stock solution of 100 ppm and to measure the absorbance was used methanol as blank, for quercetin the volume series are 2, 4, 8, 16 and 32 µL of a stock solution of 100 ppm and to measure the absorbance was used same concentration of quercetin on test resource free radicals scavenging as blank.

**RESULT AND DISCUSSION**

**1. Determination of Purwoceng Plant**

The results of determination for purwoceng plant which is done according to the book the Flora of Java (Backer and Bakhuizen, 1965) is retrieved the key determination stating the plant used is *Pimpinella pruatjan* Molkenb. with synonym *Pimpinella alpina* Molk.

**2. Extraction of Purwoceng Plant**

**a. The results of the extraction of Herbs and the leaves of Purwoceng**

10 kilograms of purwoceng plants are washed clean, drained and dried to constant weight is obtained simplicia purwoceng amounting to 1.242,88 grams so that simplicia drying shrinkage can be calculated which of 11,66%. Then separated the leaves and herbs part and powdered. Obtained purwoceng herbs powder weights was 340 grams while for purwoceng leaves was obtained 550 grams. The dry powder extracted by maceration Decker uses 3 different polarity concentrate. Ethanol 96% extract was concentrated until obtain the viscous extract of purwoceng herbs as much as 24,83 grams and viscous extract purwoceng leaves as much as 23,52 grams.

## b. Extract Characteristics

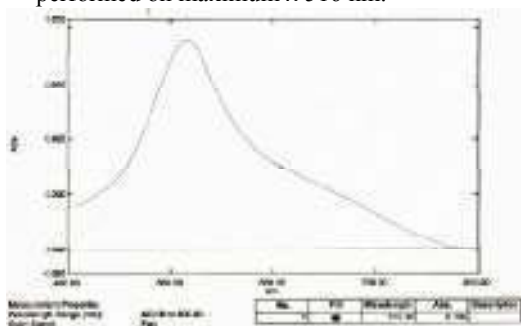
Table 1. Purwoceng Viscous Extract Characteristics

Viscous Extract	Extract Characteristics	Result
Purwoceng Herbs	1. Organoleptic a. Color b. Smell c. Flavor d. Shape 2. Rendemen	Dark green soupy Typical - Viscous solution 7,33%
Purwoceng Leaves	1. Organoleptic a. Color b. Smell c. Flavor d. Shape 2. Rendemen	Dark green soupy Typical - Viscous solution 23,52%

## 3. Determination of Resource Free Radicals Scavenging Quantitatively

### a. Results of The Determination of Maximum Wavelength ( $\lambda$ max)

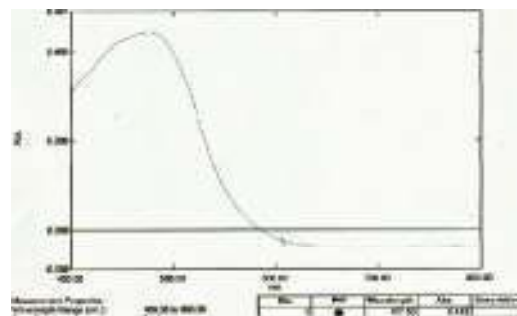
Results of maximum wavelength determination with the DPPH radical is 516 nm with maximum absorbance for an ethanol extract of purwoceng leaves is 0,756, ethanol extract of purwoceng herbs is 0,752, quercetin is 1,005 and BHT is 0,756. This means that for power of free radicals scavenging test performed on maximum  $\lambda$  516 nm.



Capture 1. Scanning ( $\lambda$  max) DPPH Solution 0,4mM

### Results of The Determination of Maximum Wavelength ( $\lambda$ max)

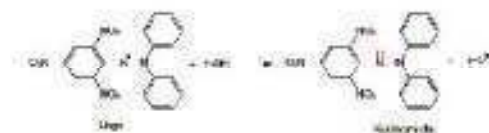
Results of maximum wavelength determination with the NO<sup>•</sup> radical is 478 nm with maximum absorbance for an ethanol extract of purwoceng leaves is 0,553, ethanol extract of purwoceng herbs is 0,553, quercetin is 0,446 and BHT is 0,443. This means that for power of free radicals scavenging test performed on maximum  $\lambda$  478 nm.



Capture 2. Scanning ( $\lambda$  max) Sodium Nitroprusside Solution 10mM

### b. Power Test Results of FreeRadicals Scavenging

Power test results capture free radicals can be seen from the percent inhibition of free radical DPPH and NO<sup>•</sup> ethanol extracts of leaves and ethanol extracts of herbs of purwoceng, quercetin and BHT which shown in tables II, III, IV and V. Where the higher concentration of the extract is used so the percent inhibition is also higher which means the better the free radicals scavenging power.



Capture 3. Electron Donation or Hydrogen Radical from Antioxidant to DPPH Radicals (Mun'im, A 2008)

Table 2. Scavenging Power of Ethanol Extract of Leaves and Ethanol Extract of Purwoceng Herbs with DPPH Radicals

Concentration (ppm)	%Inhibition Replication 1		%Inhibition Replication 2		%Inhibition Replication 3	
	Herbs	Leaves	Herbs	Leaves	Herbs	Leaves
50	33,59	25,13	38,49	26,46	39,42	27,66
40	28,17	20,61	33,33	22,21	34,39	22,74
30	21,29	15,43	24,47	16,62	25,79	17,82
20	16,01	11,44	19,05	13,03	20,50	13,83
10	5,82	6,38	8,33	6,78	9,39	7,58



Capture 4. The Reaction Between Nitric Ion with Sulphalinamide which Paired with naphthylethylenediamine (Wikipedia en, 2013)

Table 3. Scavenging Power of Ethanol Extract of Leaves and Ethanol Extract of Purwoceng Herbs with NO<sup>•</sup> Radicals

Concentration (ppm)	%Inhibition Replication 1		%Inhibition Replication 2		%Inhibition Replication 3	
	Herbs	Leaves	Herbs	Leaves	Herbs	Leaves
50	43,22	54,07	38,52	48,64	40,51	40,87
40	33,45	50,99	32,91	44,30	35,98	39,06
30	32,73	49,91	29,11	43,76	28,75	38,52
20	28,75	41,41	25,49	34,36	21,52	27,31
10	24,95	29,11	20,79	23,87	18,81	18,99

Table 4. Quercetin Free Radical Scavenging Power

Concentration (ppm)	%Inhibition Replication 1		%Inhibition Replication 2		%Inhibition Replication 3	
	DPPH	NO <sup>•</sup>	DPPH	NO <sup>•</sup>	DPPH	NO <sup>•</sup>
0,64	31,44	46,84	33,83	47,56	34,93	46,29
0,32	7,86	41,05	9,25	40,87	10,25	41,77
0,16	-3,98	39,60	-3,38	37,97	-3,18	39,78
0,08	-13,53	33,82	-13,13	35,44	-12,94	34,90
0,04	-15,32	29,29	-14,43	30,92	-14,23	29,11

Table 5. BHT Free Radical Scavenging Power

Concentration (ppm)	%Inhibition Replication 1		%Inhibition Replication 2		%Inhibition Replication 3	
	DPPH	NO <sup>•</sup>	DPPH	NO <sup>•</sup>	DPPH	NO <sup>•</sup>
8	55,56	74,32	67,99	69,08	69,71	65,28
4	32,14	70,88	42,33	66,00	43,65	60,22
2	18,52	63,47	25,66	58,23	26,72	53,89
1	4,49	47,56	7,28	41,41	7,94	43,39
0,5	2,78	41,77	5,29	35,55	5,56	36,71

Percent inhibition was analyzed to find out to know IC<sub>30</sub> value, is using curve relationship between percent barrier with a concentration (Gulluce et al, 2006). The magnitude of free radical scavenging power characterized by the IC<sub>30</sub> value, is the solution concentration of samples needed to

inhibit 30% of free radicals. The higher of I% value accordingly the IC<sub>30</sub> is lower. The lower of IC<sub>30</sub> make the better of free radical power inhibition. IC<sub>30</sub> is used because if used IC<sub>50</sub> the result can have extrapolation outside the range series of concentration.

Table 6. IC<sub>30</sub> Value of Ethanol Extract of Purwoceng Leaves, Ethanol Extract of Purwoceng Herbs and Positive Controls

Replication	IC <sub>30</sub> Value (ppm)							
	DPPH	NO*	DPPH	NO*	DPPH	NO*	DPPH	NO*
	Ethanol Extract of Purwoceng Leaves		Ethanol Extract of Purwoceng Herbs		Quercetin		BHT	
1	43,33	4,62	43,33	23,67	43,33	0,48	43,33	0,48
2	37,06	14,89	37,06	31,47	37,06	0,47	37,06	0,47
3	38,57	24,69	38,57	31,51	38,57	0,48	38,57	0,48
IC <sub>30</sub> average	38,65	14,73	38,65	28,88	38,65	0,48	38,65	0,48

From the value data of IC<sub>30</sub> can be concluded that free radical scavenging power of ethanol extract of purwoceng leaves is better then ethanol extract of purwoceng herbs.

#### 4. Comparison of Free Radicals Scavenging Power

The use of different methods for determining the free radicals scavenging power of plant extracts can shown the random results, it is difficult to compare and sometimes give rise to incompatibility (Koleva et al. 2002 in Irawati 2008).

Based on table 7. the IC<sub>30</sub> value of ethanol extracts of purwoceng leaves and ethanol extract of purwoceng herbs by DPPH radical greater than by NO\* radical. This is possible because both radical have differences in how forms a stable compound. Another possibility is a compound that plays a role in the free radicals scavenging from ethanol extract of prwoceng leaves and ethanol extracts of purwoceng herbs namely flavonoids less reactive against DPPH radical because of steric hindrance, so that only a small molecule that has a greater opportunity to react with DPPH radical (Irawati, 2008).

Table 7. Comparison of IC<sub>30</sub> Value Between DPPH Radical and NO\* Radical

Ethanol Extract	IC <sub>30</sub> Value (ppm)	
	DPPH Radical	NO* Radical
Purwoceng Leaves	38,65	14,73
Purwoceng Herbs	57,25	28,88

#### CONCLUSIONS AND SUGGESTIONS

It can be concluded that there is a difference of free radicals scavenging power between ethanol extract of purwoceng leaves and purwoceng herbs by looking at the value of IC<sub>30</sub>.

It is advisable to commit further research about the free radicals scavenging power for antother purwoceng leaves and herbs extract, both petroleum ether extract or ethyl acetate extract. Types of flavonoids compounds in the leaves and herbs of purwoceng who have power of free radicals scavenging. As well as the use of other methods to test the activity of antioxidants that can support free radical scavenging research of purwoceng plant so it can be known the right dose in order to declare that purwoceng plant is a natural antioxidants.

#### Reference

Anonim, 1979, *Farmakope Indonesia*, Edisi III, Jakarta, Departemen Kesehatan Republik Indonesia.

Backer, A.C & van der Brick, B.C.R. 1965. *Flora of Java (Spermatophytes only)*, vol II. Netherlands: N.V.P Noordhoff. Backer, A.C & van der Brick, B.C.R. 1965. *Flora of Java (Spermatophytes only)*, vol II. Netherlands: N.V.P Noordhoff.

Caropeboka, A.M. dan I. Lubis, 1975, Pemeriksaan pendahuluan kandungan kimia akar *Pimpinella alpine (purwoceng)*, Dalam *Simposium Tanaman Obat I*, 8- 9 Desember, Bagian Farmakologi. FKH, Institut Pertanian Bogor.

Caropeboka, A.M, Iskandar dan Paridjo, P, 1979, Pengaruh Ekstrak Akar *Pimpinella alpine* Koord. Terhadap Reproduksi Hewan, Dalam Usmiati, S dan Yuliani, S, 2010, *Efek Androgenik dan Anabolik Ekstrak Akar Pimpinella alpine Molk. (Purwoceng) pada Anak Ayam Jantan*, Balai Besar Penelitian dan Pengembangan Pascapanen Pertanian, Bogor.

Fessenden, Ralp J. dan Fessenden, Joan S., 1982, *Kimia Organik Edisi Ketiga*, Jakarta, Penerbit Erlangga.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Gulluce M, Aslan A, Sokmen M, Sahin F, Adiguzel A, Agar A & Sokmen A, 2006, Screening the antioxidant and antimicrobial properties of the lichens *Parmelia saxatilis*, *Platismatis glauca*, *Ramalina pollinaria*, *Ramalina polymorpha* and *Umbilicaria nylamderiana*, *J. Phytomedicine* 13 (2006) p.515- 521.
- Halliwell, B. & J.M.C. Gutteridge, 2000, *Free Radical in Biology and Medicine. Ed 4th*, New York, Oxford University Press.
- Haryono, Nugroho Tri, 2013, Purwoceng, [http://www.herbaltama.com/?Tananaman\\_Obat:Purwoceng](http://www.herbaltama.com/?Tananaman_Obat:Purwoceng) [12 Mei 2013].
- Hernawan, Udhi Eko Dan Setyawan, Ahmad Dwi, 2003, *Ellagitannin; Biosintesis, Isolasi, dan Aktivitas Biologi* [Review], Surakarta, Jurusan Biologi FMIPA.
- UNS Informasi Herbal, 2012, Purwoceng, <http://www.informasiherbal.com/purwoceng/>, [18 Desember 2012].
- Irawati, Irma, 2008, *Perbandingan Metode Penentuan Aktivitas Antioksidan Rimpang Temulawak*, [skripsi], Bogor, Institut Pertanian Bogor.
- Mun'im, A., 2008, Aktivitas Antioksidan Cendawan Suku Pleurota dan Polyporaceae dari hutan UI, *Jurnal Ilmiah Farmasi Vol.5No.1*, Jakarta.
- Waji, Resi Agestia dan Sugrani, Andi, 2009, *Flavonoid (Quercetin)* [Makalah Kimia Organik Bahan Alam], Makassar, Program S2 Kimia, Fakultas Matematika dan Ilmu Pengetahuan Alam, Universitas Hasanuddin.
- Wikipedia, 2013, *Griess Test*. [http://en.m.wikipedia.org/wiki/Griess\\_test](http://en.m.wikipedia.org/wiki/Griess_test). [24 Agustus 2013].

**DIFFERENCES INFLUENCE PLYOMETRIC EXERCISE  
WITH NEUROMUSCULAR ELECTRICAL STIMULATION (NMES)  
TO INCREASE THE ABILITY OF VERTICAL JUMP IN BASKETBALL PLAYER  
STIKES MUHAMMADIYAH PALEMBANG**

**Putri Edrivania<sup>1</sup>, Usman<sup>2</sup>, Ika Guslanda Bustam<sup>3</sup>**

Program Study DIII Physical Therapy  
STIKes Muhammadiyah Palembang

**Abstract**

**Background:** Sports game of basketball is one sport that demands various abilities both in terms of physical, technical, tactical and mental. One of the important components in the sport of basketball game that required the athletes to support her achievements is the ability of vertical jump which was strongly influenced by the strength of the muscles. Increased muscle strength can be done with exercise and plyometric, Neuromuscular Electrical Stimulation (NMES).

**Purpose:** To find out the differences influence plyometric exercise with neuromuscular electrical stimulation (NMES) to increase the ability of vertical jump in basketball player STIKes Muhammadiyah Palembang.

**Methods:** using the method of experiment (a quasi experiment) by using two research design group pre and post test with control design. The number of respondents who were involved are 20 people. This sample is divided into two groups, the first treatment plyometric training, and group treatment Neuromuscular Electrical Stimulation (NMES). To test the hypotheses used Independent Samples Test.

**Results:** Test the hypothesis Pre Test on the experimental and Control Groups with independent samples test obtained value of significance ( $0.881 > 0.05$ ) which means there is no meaningful difference between the two treatment groups, so it can be considered that the two groups operate from the same State. While testing the hypothesis on the Post Test Control Group Experiment and the significance value ( $0.194 > 0.05$ ) It means that there is no difference between the value of the vertical jump test in experimental groups (plyometric exercises) and control group (NMES).

**Conclusion:** Exercise plyometric and neuromuscular electrical stimulation (NMES) equally affect the improvement of vertical jump.

**Keywords:** Neuromuscular electrical stimulation, plyometric, capability of vertical jump

**INTRODUCTION**

The importance of the function of muscle strength in the game of basketball to do the vertical jump and prevent any risk for the occurrence of injuries in a game of basketball while playing and during competition. Saat do the vertical jump in the game of basketball so needed eksplosive limb muscles to get a great style. In an explosive train (power) limb muscles, can use one of the methods of training with plyometric training methods. Another way to improve performance is by way of provision of electrical stimulation (Kuprian, 1981: Low, 2000). *Neuromuscular Electrical Stimulation* (NMES) used to strengthen the muscles in a healthy or to maintain muscle mass. NMES used the electric current that causes one specific muscle groups or contracting. Muscle contraction using electrical stimulation may increase muscle strength (Laura, 2008).

**General Purpose**

To tell the difference between the exercise of influence with influence Neuromuscular Electrical plyometric Stimulation (NMES) against the increasing ability of vertical jump on a basketball player.

**Special Purpose**

1. To know the influence of plyometric exercises to increase vertical jump ability on the basketball player.
2. To find out the effect of Neuromuscular Electrical Stimulation (NMES) against the increasing ability of vertical jump on a basketball player.

**REVIEW OF PUSTAKA**

**The Game Of Basketball**

Basketball is a game that uses a large ball, played with the hands. The ball can be passed (thrown), be reflected to the floor either in place or while walking and the goal is to put the ball into the opponent's ring (Faruq, 2009).

According to Abidin (1999), the basic techniques in the game of basketball is: 1) Passing

and catching, 2) dribbling, 3) Shooting, 4) Pivot, 5), Rebounding.

### ***Plyometric Exercise***

Plyometric consists of muscle stretching (eccentric action) immediately followed by a concentric or shortening action on the muscles and connective tissue (Baechle and Earle, 2000). Jump up and down vertically with the object of two legs of the stool are one form of plyometrics exercises with the use of two limbs simultaneously. To perform the movement opens with a standing position facing the bench with bench 40 cm high, slightly bending the knee joint  $\pm 100^\circ$  both arms are in addition to the second joint of the elbow bent with the 900dari prefix. Then proceed with the jump to the top of the bench with both feet simultaneously and then continued with the squatting jumps down from the stool and back to land to place (floor) is done as quickly as possible according to the initial position and continued with the subsequent movement repeatedly (Maffiuletti, et al., 2002).

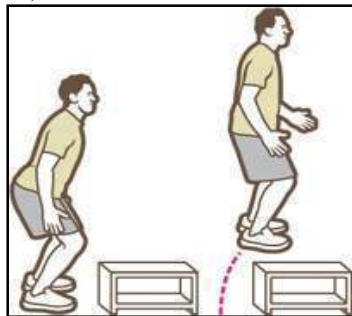


Figure 1. *Plyometric Exercise Drop Jump*  
Lubis (2005)

### ***Neuromuscular Electrical Stimulation (NMES)***

*Neuromuscular Electrical Stimulation* (NMES) is a series of applications that are intermittent stimulation on muscle, with the main purpose to trigger muscle contractions by activating the intramuscular nerve branches (Maffiuletti, 2010).

*Neuromuscular Electrical Stimulation* (NMES) generate muscle contraction directly by transcutaneous stimulation of peripheral nerves. The contractions can be generated directly, through motoneurons depolarization, or indirectly, through depolarization afferents (Collins, 2007).

Neural adaptation is an important factor in the development of muscle strength with the NMES (Maffiuletti et al., 2005). Neural adaptation by NMES occurs because this technique causes excitation of nerve branches, intramuscular and not on direct muscle fibers (Hultman et al., 1998),

which may induce activation of antidromic motor neuron and an increase in the number of nerves of supraspinal muscle on GnRH centers (Maffiuletti et al., 2002), this is due to the recruitment of a large number of motor units and improve coordination between muscles and reduce agonist antagonist coactivation (Carolan Cafarelli, 1992) can also be considered an adaptation that may explain the onset of maximal muscle contractions increase.

According to Maffiuletti (2011) NMES improves muscle strength usually in static conditions (without functional movement occurs) and high enough to evoke the intensity of muscle contraction. NMES excellence include: 1) tools for strength training in healthy subjects such as athletes, may cause similar neuromuscular adaptation/complementary to volunteer, strength training, 2) As preventive and rehabilitation of the patient, in order to maintain muscle mass and muscle function, and 3) test as a tool to evaluate nerve function and/or muscle strength, therefore able to stimulate muscle contraction and mechanical properties (torque) that can be measured and recovery tool for athletes post-exercise, due to acute application can increase muscle blood flow and therefore can accelerate recovery during and after exercise.

One used in electric currents NMES using *Transcutaneous Electrical Nerve Stimulation* (TENS). The type of the current TENS muscle contraction required to generate the phase duration and exact frequency. The duration of this phase is commonly used 100-150  $\mu$ s. The frequency can be adjusted according to the type of muscle tissue (phasic or tonic). The required frequency by a muscle or muscle group to be able to produce a contraction of tetanic as found in the physiological contractions known as *critical fusion frequency* (CFF) the magnitude depends on the location/region group of muscles and muscle type in question or that wicker or tonic. For the muscle of the wicker range of CFF 30-100 Hz. Generally frequency 50 Hz can be selected to generate a comfortable tetanic contraction (Adel and Luykx, 1990). Burst pattern mengaktifasi fibre TENS G III, A delta ergoseptor that can cause the contraction of the muscles of the wicker which ended in small diameter non-neural activation noksius. Intensity/amplitude contractions occurred until a real quantity kontraksinya depending on the condition of the muscles as well as the purpose of the granting of NMES. For example to correct a sub-luksasi shoulder going on NMES applied on the deltoid muscle posteriorly and supraspinatus tests with duration 100-200  $\mu$ s and the intensity of



the adjustment is to cause muscle contraction equal to the value of 2 or 3 in the Manual Muscle of the Tasting (MMT) to produce a wicked muscle contractions are strong enough but is inconvenient (Parjoto, 2006). In this study used is the type of flow of TENS with the duration 100-150  $\mu$ s, frekuensi 30-100 Hz, the intensity of muscle contraction on par with a value of 2 or 3 in MMT so produced muscle contraction is quite strong but comfortable with granting time for 15 minutes.

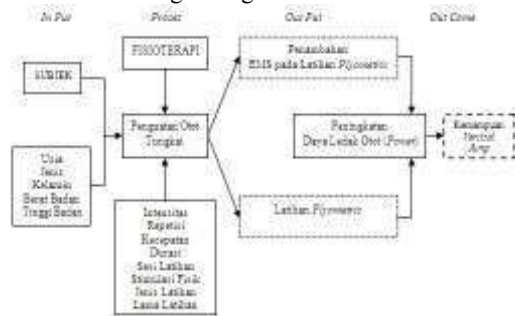


Figure 2. Framework concept chart

## METHODS

### Subjects

The subjects of the research used in this study were 20 people who were students of the DIII Physiotherapy STIKes Muhammadiyah Palembang active playing basketball and avidly follow the exercise.

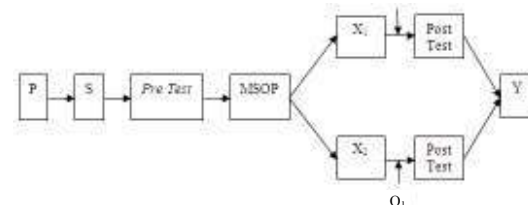


Figure 3. Design research

### Instruments Research

#### Plyometric Exercise

Plyometric exercises are conducted three times a week for eight weeks (14 sessions). Each session lasted 50 minutes, consists of the following parts: a 10-minute warm up (perform stretching exercises: running then), 30-minute plyometric exercises and 10-minute cooldown (Maffiuletti et al., 2005).

Table 1. Accoutrements Plyometrics And How To Do Exercises

Types Of Exercise	<i>Drop Jump</i>
Equipment	5 chairs with high $\pm 40$ cm
Starting position	Sample standing in front of a Chair
Action	Sample hopped on the bench from the standing position at the top of the bleachers and crouching down and then extend your knees in one continuous movement. In order for maximum intensity during the jump.

Table 2. *Plyometric Exercise*

Week	Volume Exercise	<i>Plyometric Exercise</i>	Set $\times$ Reps	Intensitas Exercise	Rest Time	Frequency
1 & 2	50	<i>Drop Jump</i>	5 $\times$ 10	Middle	5 Minutes	2 $\times$ /weeks
3 & 4	50	<i>Drop Jump</i>	10 $\times$ 5	Middle	3 Minutes	2 $\times$ /weeks
5 & 6	60	<i>Drop Jump</i>	6 $\times$ 10	Middle	5 Minutes	2 $\times$ /weeks
7 & 8	60	<i>Drop Jump</i>	10 $\times$ 6	Middle	3 Minutes	2 $\times$ /weeks

### Neuromuscular Electrical Stimulation (NMES)

*Neuromuscular Electrical Stimulation* (NMES) used in this research is with the current TENS Burst pattern. Therapeutic time 10 minutes with 115-120 Hz frequency, the phase duration 400  $\mu$ s maximum tolerance and intensity varies between 0-100 mA depending on the subject of tolerance thresholds. Electrical stimulation is given three times a week for four weeks. Samples sit with knee joint full extension. Wet all electrodes with water. Pairs of the positive electrode as close as possible on motor point muscle Vastus Medial (VM) and

Vastus Lateral (VL) and negative electrode placed at the proximal quadriceps muscle (1-3 cm under inguinal ligament). Then difiksasi or fastened with cords to elektrodanya does not shift. Set time therapy, and raise intensity to extent tolerance samples (fortis). As time therapy has been exhausted hence lower intensity and off all electrodes mounted then turn off a appliance.



Figure 4. Strengthening a muscle with NMES  
Adel dan Luykx (2005)

### Vertical Jump Test

*Vertical Jump Test* It aims to measure the power leg muscles by measuring the difference in maximum coverage at the time stand up and jump at the time by using a scale wall cm. range of stand is how high someone elongation 1 arm overhead dilantai stepped with both feet. The reach of the leap that jump over it without stepping in and touching one point as high as possible. Starting positions for the leap on the vertical jump test is a factor that must be considered so that test results become higher.

Tools required is a wall that has been given the size of the scale in cm, marker jumps such as limestone Lake or water will be provided on the fingers that will touch the wall.

Table 3. Category value of vertical jump test

Categor	Male	Female
less	38-45	28-35
enough	46-52	36-42
good	53-61	43-51
excellent	62-69	52-59
perfectly	>70	>60

Atmojo (2007)



Figure 5. Vertical Jump Test

## RESULTS

Table 4. The Ability Of Vertical Jump Test

Test	Vertical Jump Plyometric Exercise				Vertical Jump NMES			
	Min	Max	Mean	SD	Min	Max	Mean	SD
Pre	28	43	35.00	4.738	30	34	35.30	4.084
Post	31	51	43.00	6.667	34	46	39.60	4.274

Source of the data processed 2013

Table 5. Test results the difference Pre Test experimental and Control Group

Variabel	Group	N	Mean	SD	(t)	Sig.(2-tailed)
Pre VJT	Plyo Exp	10	35.00	4.738	-.152	0.881
	NMES	10	35.30	4.084		

Source of the data processed 2013

The test of Independent Samples Test performed on pre-commit test experimental group and the control group gained value (t) -.152 with a value of significance (0.881 > 0.05) which means there is no meaningful difference between the two

treatment groups, so it can be considered that the second group departs from the same State, then a second group of assumptions can be taken from the homogeneous initial potential.

Table 6. Result test a difference pre and post test group experiment

Group	N	Mean	SD	(t)	Sig.(2-tailed)
Pre Vertical Jump Test	10	35.00	4.738	-9.639	0.000
Post Vertical Jump Test	10	43.00	6.667		

Source of the data processed 2013

Test of paired samples statistics performed on pre-commit and post vertical jump test experimental group obtained the value significance 0.000 ( $p < 0.05$ ), that means that there is a

meaningful difference before and after exercise to upgrade the plyometric vertical jump twice a week for eight weeks.

Table 7. Result test a difference pre and post test group of control

Group	N	Mean	SD	(t)	Sig.(2-tailed)
<i>Pre Vertical Jump Test</i>	10	35.30	4.084	-11.727	0.000
<i>Post Vertical Jump Test</i>	10	39.60	4.274		

Source of the data processed 2013

Of paired test samples statistics performed on pre and post vertical synchronization jump test group control obtained the value of significance 0.000 ( $p < 0.05$ ), that means that there are

meaningful differences influence before and after the awarding of NMES to increased vertical jump ability twice a week for eight weeks.

Table 8. Post Difference test results Test Experimental and Control Group

Variabel	Group	N	Mean	SD	(t)	Sig.(2-tailed)
<i>Post</i>	<i>Plyo Exp</i>	10	43.00	6.667	1.358	0.194
<i>VJT</i>	NMES	10	39.60	4.274		

Source of the data processed 2013

The test of Independent Samples Test done on post test control group and experimental group obtained the value of (t) 1,289 with significance value (0.194 > 0.05) It means that there is no difference between the value of the vertical jump test in experimental group (plyometric exercises) and group control (NMES).

## DISCUSSION

### Characteristic Of Respondents

The age of the respondents in this study is more than 18 years of age and not more than 22 years. Adolescence is the period of active growth in the system of the human body where every form of exercise that can actively responded to complaints given by the system the body muscle system so that one of them was able to establish and enhance muscle strength (power) to jump to the maximum vertical capabilities. In addition, in the youth like this is the right time for planting maximum basic skills honed as a mature athlete. Results of previous research indicates that maximum muscle strength occurs at the time of age <30 years, muscle endurance will be reduced to 1% each year (Budiharjo, 2005). Muscle strength and the amount of power generated by the muscle decreases with increasing age.

Description *Body Massa Index* (BMI) respondents pointed out the BMI respondents at the time of research conducted revealed that all of the respondents belonging to the category of normal BMI (20-25 kg/m<sup>2</sup>), there are 20 respondents or 100% of the total sample of research. This is noteworthy because when BMI exceeds 25 kg/m<sup>2</sup> It

is certain that people have trouble when you want to do the sport of basketball. Because, in the sport of basketball is demanding a lot of rapid movement and Frisky in the running ball or jump to do a shoot. Vertical jump ability distribution description of respondents indicated the ability of vertical jump at the time respondent exercised good pre and post test results from the measurement of the vertical jump ability according to Atmojo (2007) for the measurement of vertical jump. The average ability of respondents fall into the category fairly (36-42) and the category less (28-35).

### Data analysis

#### a. Influence Exercise *Plyometric* Against Enhancement Ability *Vertical Jump*

The test results indicate that the effect before and after treatment *plyometric* exercises to increase in *vertical jump* ability of basketball players after the exercise program twice a week for eight weeks there is a significant improvement of *vertical jump* ability in basketball players. The results of this study support previous narrative reviews (Markovic, 2007) who have concluded that *plyometric* training is an effective training method for improved *vertical jump* ability and relevance for trained athletes in sports that achieve optimum *vertical jump*. Something similar is consistent with the theory proposed by Radcliffe and Farentinos (2002) that *plyometric* exercises can increase the *power* by a combination of isometric and isotonic exercises (eccentric-concentric) that uses dynamic loading. Strain that occurs suddenly before returning the muscle to contract or a practice that

allows the muscles to reach maximum force in the shortest possible time.

*Plyometric* refers to exercises designed to increase muscular strength, especially through training jumps. *Plyometric* exercise is mostly a natural part of the movement because it involves sports movements such as *vertical jump*, throw, or kick (Anderst *et al.*, 2000).

Biomechanical analysis of jumping motion influenced the mechanical motion of the muscle group that connects the two joints in the lower limbs the *quadriceps femoris*, *hamstring* and *gastrocnemius* silmutan that moves simultaneously with isometric and isotonic movements (Lopez, 2009). *Plyometric* exercises are exercises that enable a muscle to reach maximum force in the shortest possible time (Chu, 1998).

Komi *et al.*, (1997) found that an increase in *vertical jump* ability can be attributed to a combination of elastic energy utilization and potential activation of the muscle *stretch reflex*. In a follow-up study, Bosco *et al.*, (1999) found that an increase in the average ability of *vertical jump* by 66 to 81%.

b. Influence *Neuromuscular Electrical Stimulation* (NMEs) Against Enhancement Ability *Vertical Jump*

The test results indicate that the effect before and after treatment NMEs addition to the increased ability of *vertical jump* basketball player after following an exercise program twice a week for eight weeks. This is consistent with the theory put forward by Laura (2008) that the NMEs may cause one or more specific muscle groups to contract. Muscle contraction using this *electricalstimulation* can increase muscle strength.

According Maffiuletti, *et al.*, (2000) NMEs will increase the strength of the eccentric, isometric, and concentric *knee extensor*, and *vertical jump* ability. This suggests that the NMEs can develop muscle strength and *vertical jump* ability without performance *Stretch-Shortening Cycle* (SSC) in a group of basketball players can be achieved in a relatively short time. So NMEs an effective stimulus in developing maximal strength. This is consistent with the statement of Martin *et al.*, (1993) and Pichon *et al.*, (1995) which states that a brief period of NMEs has a beneficial effect on muscle strength.

According Maffiuletti *et al.*, (2000) NMEs can develop muscle strength and *vertical jump* in a group of basketball players administered after 8 weeks of intervention NMEs are a significant improvement of *vertical jump* ability. It is also

supported by the statement of Kot's (2003) in his theory which states that if all the motor units recruited, the muscle can perform a maximum contraction, and that the training sessions of NMEs muscle tension will increase and develop the capacity of the power. In NMEs (Tens pattern Burst) produces motor activation to induce muscle contractions *phasik*. For high amplitude muscle stimulation is used to generated a strong muscle contraction (of the motor stimulation level until the limit of tolerance).

By some definitions and conclusions of the above studies, it can be concluded that by stimulating the *quadriceps femoris* muscle EMS, it can increase the muscle strength simultaneously.

c. Difference Influence Exercise *Plyometric* and *Neuromuscular Electrical Stimulation* (NMEs) Against Enhancement *Vertical Jump*

Based on the test results it can be concluded that there is no difference between the effect of *plyometric* training can increase *vertical jump* ability of a basketball player.

## CONCLUSIONS AND SUGGESTION

### Conclusion

1. Administration exercise *plyometric* can take effect in meaningful against enhancement ability *vertical jump* on basketball player.
2. Administration *Neuromuscular Electrical Stimulation* (NMEs) can take effect in meaningful against enhancement ability *vertical jump* on basketball player.
3. Not there significant differences between administration exercise *plyometric* and administration *Neuromuscular Electrical Stimulation* (NMEs) to enhancement ability *vertical jump* on basketball player.
4. Good with exercise *plyometric* nor with administration *Neuromuscular Electrical Stimulation* (NMEs) in basketball players are equally can increase ability *vertical jump* on basketball athletes.

### Suggestion

In this research can not be separated from the limitations and shortcomings, to add to the treasures of science similar to this study, researchers suggest the need for further research to increase the sample size or respondents, and with a longer time. As well as observing and controlling the factors that can influence research results.

## References

- Adel, R.V. den., Luykx., R.H.J. (2005). *Low and medium Frequency Electrotherapy*. Rotterdam: Enraf-Nonius B.V
- Atmojo, Mulyono, B. (2007). *Tes dan Pengukuran Dalam Pendidikan Jasmani/Olahraga*. Surakarta: UPT Penerbitan dan Pencetakan UNS (UNS Press)
- Chu, D.A. (1998). *Jumping into plyometrics*. Champaign, Illinois: Human Kinetics. Pub.,
- Faruq, M., Muhyi. (2009). *Meningkatkan Kebugaran Jasmani Melalui Permainan dan Olahraga Bola Basket*. Surabaya: PT. Gramedia Widiasarana Indonesia
- Fatkurrohman, M. (2010). *Teknologi Stimulasi Elektrik (Electrical Stimulation) Bagi Pasien Yang Mengalami Kelemahan Otot Dan Nyeri*. Keperawatan Medikal Bedah FIK-UI
- Godfrey, Richad. (2006). *Detraining – Why a Change Really is Better Than a Rest*. Diakses tanggal 03/01/2012 dari <http://www.pponline.co.uk/encyc/detraining.htm>
- Janda, V. (2000). *Muskelfunktionsdiagnostik, Muskeltest Untersuchung Verkürzter Muskeln, Untersuchung der Hypermobilität*. Verlag Acco, Leuven, België
- Kraemer WJ, Ratamess NA. (2004). *Fundamentals of Resistance Training: Progression and Exercise Prescription*. Med Sci Sport Exercise. 36: 674-688
- Kirkendall, Don R., Gruber, Joseph J., dan Johnson, Robert E. (1980). *Measurement and Evaluation for Physical Educators*. Dubuque: Wm. C. Brown Company Publisher
- Kutz, R., Matthew. (2003). *Theoretical and Practical Issues for Plyometric Training*. NSCA's Performance Training Journal, Volume 2:10-12
- Kots, Y.M. (1977). *Lectures and Laboratory Periods. Symposium on Electrostimulation of Skeletal Muscles*. Concordia University, Montreal/Quebec, Canada, December 6<sup>th</sup> -15<sup>th</sup>
- Kots, Y.M. (2006). *Effect of Plyometric Training on Running Performance and Vertical Jumping in Prepubertal Boys*. J Strength Cond Res;20:441-5
- Laura, Inverarity. Di akses tanggal 19/12/2008. *Peralatan dan Pelayanan Fisioterapi*. Dari <http://seripayku.blogspot.com/2008/03/peralatan-dan-pelayanan-fisioterapi.html>
- Leiber, R. L. (1992). *Skeletal Muscle Structure and Function: Implications for Rehabilitation and Sport Medicine*. Baltimore: Williams dan Wilkins
- Lubis, Johansyah. (2005). Di akses tanggal 08/11/11. *Mengenal latihan pliometrik*. Dari [http://google.com/archive/Mengenal Latihan Pliometrik.pdf](http://google.com/archive/Mengenal_Latihan_Pliometrik.pdf).
- Maffiuletti NA, Cometti G, Amiridis IG, Martin A, Pousson M, Chatard J-C. *The Effects of Electromyostimulation Training and Basketball Practice on Muscle Strength and Jumping Ability*. Int J Sports Med 2000; 21: 437-443
- Maffiuletti, N. A., S. Dugnani, M. Folz, E. Di Pierno, and F. Mauro. (2002). *Effect of combined electrostimulation and plyometric training on vertical jump height*. Med. Sci. Sports Exerc. Vol. 34, No. 10, pp. 1638-1644
- Maffiuletti, N. A., J. García-López., M. Izquierdo., J. A. Herrero. (2005). *Electromyostimulation and Plyometric Training Effects on Jumping and Sprint Time*. Physical Activity and Sport Sciences Faculty, University of Leon, Spain. Int J Sports Med. New York. ISSN 0172-4622
- Maffiuletti, N. A., M. Pensini, and A. Martin. (2002). *Activation of human plantar flexor muscles increases after electromyostimulation training*. J. Appl. Physiol. 92:1383-1392
- Malisoux L, Francaux M, Nielens H, et al. (2006). *Stretch-Shortening Cycle Exercises: An Effective Training Paradigm To Enhance Power Output Of Human Single Muscle Fibers*. J Appl Physiol;100:771-9
- Michael G. Miller, Jeremy J. Herniman, Mark D. Ricard, Christopher C. Cheatham dan Timothy J. Michael. (2006). *The Effects of a 6-Week Plyometric Training Program on Agility*. University of Texas-Arlington, USA: Journal of Sports Science and Medicine: 5, 459-465
- Moore, Christopher A., and Schilling, Brian K. (2005). *Theory and Application of Augmented Eccentric Loading*. National Strength and Conditioning Journal. 27(5), 20-27
- Notoadmojo, Sukidjo. (2002). *Metodologi Penelitian Kesehatan*. Edisi Revisi. Jakarta: Rineka Cipta
- Parjoto, Slamet. (2006). *Terapi Listrik Untuk Modulasi Nyeri*. Semarang: IFI
- Physical Task Training (PTT).. (2006). *Drug Enforcemen Administration*. [www.dea.gov](http://www.dea.gov) U.S Department of Justice
- Pichon F, Chatard JC, Martin A, Cometti G. (1999). *Electrical Stimulation and Swimming Performance*. Med Sci Sport Exercise. 27: 1671-1676
- Potash D.H., Chu, D.A. (2008). *Plyometric Training*. In RW Earle and TR Baechle (Eds.), *Essentials of Strength Training and*

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Conditioning (pp.413-456). Champaign,IL:  
Human Kinetics
- Priyatno, Duwi. (2010). *Paham Analisa Statistik Data dengan SPSS*. Edisi Pertama, Yogyakarta: MediaKom
- Rajtsin LM. *The effectiveness of isometric and electrostimulated training on muscle strength at different joint angles*. Theory PracPhys Cult 1974; 12: 33–35. Translated in: Yessis Rev Soviet Phys Educ Sport 1974; 12; 11: 35–39
- Shaji, John dan Isha, Saluja. (2009). *Comparative Analysis of Plyometric Training Program and Dynamic Stretching on Vertical Jump and Agility in Male Collegiate Basketball Player*. Dept. of Sports Physiotherapy, Manav Rachna International University, Haryana. Al Ame en J Med Sci.2 :6 -4 6
- Vujnovich, AL. (1995). *Hypertrophy and Hyperplasia in Skeletal Muscle Following Endurance Training*. New Zealand Journal of Physio Therapy, Dec., 13-1



## THE CORELATION BETWEEN KNOWLEDGE OF ANEMIA WITH ANEMIA INCIDENT IN PREGNANTS

Beti Rahayu Utami<sup>1</sup>, Wilis Dwi Pangesti<sup>2</sup>

### **Abstract**

**Background:** Anemia in pregnancy is an issue that can affect greatly to the quality of human resources and the potential harm both mother and the baby where anemia is one of the predisposing factors of bleeding may be the biggest causes of AKI (maternal death rate) beside infection and pre-eclampsia. Data recorded in Banyumas Public Health Centers in 2011 there were 109 pregnant women with anemia and 179 pregnant women who do not suffer from anemia over 288 pregnant women were hemoglobin level was examined. If a pregnant woman understand enough about the knowlegde of anemia, it directly reduce the risk factors of anemia also potential of morbidity and mortality of mothers and children.

**Purpose:** To determine the relationship level between knowledge about anemia in pregnant women the incidence of anemia in pregnant women in the work area Banyumas Public Health Center.

**Methods:** This type of research is a descriptive study with crossectional method. Variables studied were the level of pregnant mother knowledge and the incidence of anemia, the object are all pregnant women in the work area Banyumas Public Health Centers. Sampling taken 93 people to use a descriptive formula katagorik with an error rate of 5%. Data analized with chi square test.

**Results:** The level of maternal knowledge of anemia among pregnant women in Banyumas Public Health Center 2012 are medium knowledge with 48 people (51,6%) and the smallest with a good knowledge category with 17 people (18, 3%). The incidence of anemia in pregnant women in Banyumas Public Health Center work area in 2012 are 43 people (46.2%) and pregnant women that not suffer for anemia are 50 people (53.8%). The results obtained there is no significant association between levels of maternal knowledge of anemia with the incidence of anemia in pregnant women it's indicated by the value of a probability of 0,210 or more than conclusion  $\alpha = 0,05$ .

**Final Result:** There are no connection between maternal knowledge with the incidence of anemia in the work area Banyumas Public Health Centers.

**Keywords:** Knowledge, Pregnant Women and Anemia

### **INTRODUCTION**

Pregnancy is a natural process that can change in the woman body. One significant change is the expansion of blood volume with an increase in plasma volume and usually decreased in hematocrit (Cunningham, Gary F., et al., 2006; h. 1463). When woman get pregnancy, the blood will increase a lot, which is commonly called hidremia or hypervolemia. However, the increase in blood cells is less than the increase in the plasma, it effects to the dilution of blood (Wiknjosastro, et al. 2002; h. 448), and this is well known as anemia.

Anemia in pregnant women is not usually the case when the concentration of hemoglobin less than 12 g/dl and during pregnancy or postpartum is less than 10 g/dl (Cunningham, et al., 2006; h. 1463). Anemia in pregnancy can be caused by iron deficiency, and anemia is a type of treatment that is relatively easy, even cheap. Anemia in pregnancy is a national problem because it reflects the value of socio-economic welfare of society, and had enormous influence on the quality of human resources and potential harm besides the mother and child, because that's anemia require serious attention of all parties involved in health care at the front linear (Manuaba, 2010; h. 237).

Anemia is one of the problems that occurs in pregnant women of the world, including in Indonesia. Worldwide frequency of anemia in pregnancy is quite high, ranging between 10% and 20%. Due to deficiency of food plays a very important in the onset of anemia, it can be understood that the frequency was higher in the country-the developing countries compared with countries that have been developed. According to Hoo Swie Tjong frequency of anemia in pregnancy is as high as 18.5%, 57.9% and pseudoanemia pregnant women with hemoglobin of 12 g/100 ml or more as much as 23.6% (Wiknjosastro, et al. 2002: 450).

According to WHO, the incidence of anemia of pregnancy ranged between 20% and 89% by setting Hb11g% (11g/dl) as the baseline. The rate of anemia of pregnancy in Indonesia is still quite high. Hoo Swie Tjong found anemia pregnancy

rate of 3.8% in the first trimester, second trimester 13.6%, and 24.8% in the third trimester and contained approximately 70% of pregnant women in Indonesia were anemic due to malnutrition. On further observation, it shows that most people in the suffering of anemia are iron deficiency. It can be overcome by administration of iron on a regular basis and improved nutrition (Manuaba, 2010; h. 237-238).

Many of the problems that can be caused in pregnant women due to pregnancy are followed by anemia. Anemia in pregnancy adversely affect to the mother, both in pregnancy, childbirth and the postpartum period and beyond. Various diseases can arise due to anemia, such as abortion, parturition prematurus, prolonged labor due to uterine inertia, shock, infection of intra -partum and post partum, and in very severe anemia Hb less than 4 g/100 ml, it can cause decompensatio cordis, as in report by Lie-Injo Luan Eng et al. Hypoxia due to anemia can lead to shock and death of the mother in difficult childbirth, although there is no bleeding (Wiknjosastro, et al. 2002; h. 450).

According to data from Indonesia Demographic and Health Survey of 2007 found in Indonesia health profile book mentions that the MMR for a period of 5 years prior to the survey (2003-2007) of 228 per 100,000 live births (Ministry of Kes, 2011; h. 38) and according to the data recorded in Banyumas PublicHealth Center in 2010 the maternal mortality rate was 116.8/1,000 live births and the infant mortality rate of 1.56/1,000 live births (Anonimus. 2010; h. 8-9). High maternal mortality rate caused by obstetric complications include bleeding, infection, and pre-eclampsia by 90% and the data contained in the health profile book Banyumas District Health Office, the cause of death caused by bleeding, amounting to 8 people. Anemia is one of the predisposing factors cause bleeding and infection (Wiknjosastro, 2002: p. 450). In 2011 there were 109 pregnant women suffer from anemia and recorded 179 pregnant women who do not suffer from anemia of 288 pregnant women were examined at the Public Health Center level haemoglobin Banyumas and it shows that there are many experienced anemia in pregnant women Puskesmas Banyumas.

From the interviews that have been conducted by researchers at the survey pendahuluan to 10 pregnant women in Banyumas Puskesmas are 5 pregnant women who do not know about anemia and anemia do not know deeply about. Pregnant women interviewed only know that pregnant women can occur and to prevent anemia by taking

iron tablet because most pregnant women only if the anemia is caused due to knowing she was pregnant, though anemia in pregnant women can occur not only due to pregnancy. Anemia can occur due to malnutrition/mal nutrition, lack of iron in the set menu, which is not a good absorption/absorption to the mall that much blood loss as in the case of the last delivery, in women with regular menstrual happens every month, and chronic disease such as tuberculosis, lung, intestinal worms, malaria and others (Marni, et al, 2011; h.51). Of the pregnant women interviewed many do not know about the factors that may be the cause and the dangers of anemia and its prevention is good. It shows that pregnant women who are the subject of the interview is not much to know about anemia, its causes, how to cope and consequently danger. This is due to lack of knowledge on maternal Public Health Center in the working area of Banyumas.

Knowledge and know this is the result of the conduct occurs after sensing to a particular object. Sensing occurs through human senses, namely: the senses of sight, hearing, smell, taste, and touch. Most human knowledge acquired through the eyes and ears (Notoatmodjo, 2007; h. 143). Therefore, the level of knowledge on a person is different from others. People who are only at the most basic level of knowledge and limited know that at the highest level which can be evaluated will have different attitudes and actions in the same issue. A person's level of knowledge will be able to influence the attitudes and actions of the person.

This can actually be overcome by consuming as much iron as a minimum of 90 tablets (Manuaba, 2010; h. 239) were taken regularly every day or by eating foods that contain lots of iron so it does not suffer from anemia during pregnancy. If a pregnant woman get enough understanding that it can be lowered incidence of anemia and indirectly can reduce a variety of risk factors that occur as a result of anemia, including potential causes of morbidity and mortality of mothers and children (Wiknjosastro, 2002: p. 451)

Therefore, we should carry out research on the relationship of the level of knowledge of pregnant women with anemia in pregnant women in the region of Banyumas Public Health Center.

## METHODS

This is a descriptive study through cross sectional method to examine the relationship of knowledge about anemia pregnant women with anemia in pregnant women in the area of Banyumas done in PublicHealth Center during October 2011- July 2012. The population covered 348 pregnant



women with a number of 93 samples. Questionnaire was done to measure the knowledge of anemia. For analyzing the data, the researcher applied univariate, bivariate through chi square test.

## RESULTS AND DISCUSSION

### The Characteristics of Pregnant Women in the Area of Public Health Center Banyumas

Table 1. The Distribution of Pregnant Characteristics in the Area of Public Health Center Banyumas

Characteristic	n (%)
Age	93 (100)
20-30 th	
Parity	
Multigravida	46 (49,5)
Primigravida	47 (50,5)
Economic Status	
Low	75 (80,6)
High	18 (19,4)

Table 1 shows that the majority of the 93 respondents aged 20-35 years which has a number of 93 people (100%), primigravida is some 47 people (50.5%), have a low economic status of 75 persons (80.6%).

### The Correlation of Characteristics and Anemia Incidents in Pregnant Women in the Area of Public Health Center Banyumas

Table 2. The Correlation of Characteristics and Anemia Incidents to Pregnant Women in the Area of Public Health Center Banyumas

Characteristics	P
Age	0,299
Parity	0,471
Economic Status	0,486

Table 2 proves the relationship between age of pregnant women with anemia,  $p$  (probability) = 0.299 where the probability is greater than  $\alpha = 0.05$ , the correlation between parity pregnant women with anemia,  $p$  (probability) = 0.471 where the probability value is greater than  $\alpha = 0.05$ , and the relationship between the economic status of pregnant women with anemia,  $p$  (probability) = 0.486 where the probability is greater than  $\alpha = 0.05$ .

### Frequency Distribution of Knowledge of Anemia in Pregnant Women in the Area of Public Health Center Banyumas

Table 3. The frequency distribution of Knowledge about in pregnant women in the Area of Public Health Center Banyumas

No	Knowledge	F	%
1.	Fine	17	18,3
2.	Moderate	48	51,6
3.	Less	28	30,1
	Total	93	30,1

Table 3 shows from 93 respondents who have a good knowledge is 17 people (18.3%), and who have less knowledge is 28 people (30.1%).

### The frequency distribution of anemia incident in pregnant women in the area of Public Health Center Banyumas

Table 4. The Distribution of anemia incident in pregnant women in the area of Public Health Center Banyumas

No.	Parity	F	%
1.	Anemia	43	46,2
2.	Not Anemia	50	53,8
	Total	93	100

Table 4 shows that the incidence of anemia among respondents in Public Health Center Banyumas in 2012, who suffered anemia is 43 people (46.2%) and not anemia is 50 people (53.8%).

### The Relationship of Maternal Knowledge and Anemia Incidents in the Area Public Health Center Banyumas

Table 5. Relationship of Maternal Knowledge and Genesis Anemia Anemia in Pregnant Women in the Work Area Banyumas Public Health Center

Mothers' Knowledge	Anemia				Total		$\chi^2$	$p$
	Anemia		Not anemia					
	f	%	F	%	f	%		
Fine	9	9,7	8	8,6	17	18,3	3,121	0,210
Moderate	18	19,4	30	32,3	48	51,6		
Less	16	17,2	12	12,9	28	30,1		
Total	43	46,2	50	53,8	93	100,0		

Table 5 mentions that respondents who experienced anemia was higher in mothers who get moderate knowledge (19.4%) compared with mothers whose less knowledge is (17.2%) and good is (9.7%).

The Results of statistical analysis of the relationship between knowledge about anemia pregnant women with anemia obtained  $p$  (probability) = 0.210. Probability value is greater than  $\alpha = 0.05$ .

## DISCUSSION

### The Knowledge of Pregnant Women about Anemia in the Area of Public Health Center Banyumas

Based on Table 3, the results of research that has been conducted on 93 respondents have showed that having a fine knowledge of some 17 people (18.5%), having moderate knowledge is 48 people (51.6%) and those with less knowledge is 28 people (30.1%).

The highest level Knowledge is in the moderate knowledge category, this is effected by the different material acceptance in each individual because it is the result of knowledge and know this happens after the person doing sensing to a particular object. Sensing occurs through human senses, namely: the senses of sight, hearing, smelling, tasting, and touching. Most human knowledge acquired through the eyes and ears so that it could cause a different level of understanding between individuals that occur as a result of acceptance through the five senses. The level of knowledge that occurs can differ from knowing, understanding, application, analyzing, synthesize and evaluation. Knowledge or cognitive holds a very important domain to the creation of one's actions.

Knowledge is as a continuous formation by a person who at any time was reorganized as a new understanding. The results of this study are supported by Notoatmodjo which states that knowledge or cognitive domain is very important for the formation of one's actions.

It can be concluded that the knowledge in pregnant women in Public Health Center (Puskemas) Banyumas are most in moderate category.

### Anemia incidents in Pregnant Women in the Area of Puskesmas Banyumas

Based on Table 4, it is known that more pregnant women who do not suffer from anemia than not. This is in line with the results of the study done by Rismiana (2005) which found the

incidence of anemia was 28% and that is not classified as anemia was 72%.

In this study obtained many pregnant women with anemia level. It shows that pregnant women in Puskesmas Banyumas as respondents in this sample were not in anemia, but not necessarily with anemia in low level. It happens since pregnant women in Puskesmas Banyumas always check themselves to health professionals and get the appropriate standard of care includes taking iron tablet are given for each visit pregnancy check for anemia. It can be addressed by taking iron tablets at least 90 tablets, starts with one tablet a day as soon as possible after the nausea gone.

The government has adopted a program for pregnant women where antenatal visits should be conducted at least four times during pregnancy which is one in the first quarter, one in the second trimester and twice in the third trimester with one objective to improve and maintain physical health, mental, and the social mother and baby and to recognize early any abnormalities or complications that may occur during pregnancy, including disease history in general, obstetrics, and surgery. Anemia is a disease which can lead to complications of pregnancy, childbirth and post-partum and as a potential cause of maternal death due to anemia which is one of the factors predisposing to hemorrhage.

In midwifery care services, or commonly known as the ANC, pregnant women can be served by a qualified healthcare both obstetricians, general practitioners, including midwives which always has a standard in the midwifery care. There is a chance for pregnant mothers in Puskesmas Banyumas not to suffer anemia due to their activeness in doing pregnancy care to the practitioners, thus it reduces the incidence of anemia.

We need followed up activities for anemic or serious problem may arise and can endanger to the mother and fetus (a potential danger for both mother and child) and a very large impact on human resources. Therefore, iron deficiency anemia requires serious attention by all parties involved in health care. Anemia due to pregnancy complications may occur including abortion, premature labor, and fetal growth in the womb. Not only alone, but anemic in pregnancy can adversely impact on the process of childbirth as his interference (pushing force), the first time can be long, and parturition occurs displaced, the second stage can last long so tiring and often requires surgery obstetrics, when uri can be followed by retained placenta, and postpartum hemorrhage due to uterine atony, when four can occur secondary

postpartum hemorrhage and uterine atony and anemia due to the dangers that occur when puerperal uterine subinvolution cause postpartum hemorrhage, puerperal infection ease, breastfeeding reduced expenses, sudden cardiac decompensation occurred after labor, anemia when parturition, mammary infections occur easily. In addition to the above-mentioned danger, the danger of anemia may also occur in the fetus. Although it seems the fetus is able to absorb the various needs of the mother, but the anemia will reduce the ability of the body's metabolism so that interfere with the growth and development of the fetus in the womb. Anemia due to an interruption in the form of: abortion, death intrauterine, prematurity high labor, low birth weight, birth defects can occur with congenital anemia, easy baby got the infection through perinatal death, and low intelligence.

Anemia in pregnant women in large part due to iron deficiency and effect to hemodilution but the actual occurrence of anemia in pregnant women can also occur as a result of the pregnant women suffer from malaria, hookworm disease, excessive demands, for example, in women who often experience pregnancy, or twin pregnancy and disease hemoglobinopathies. In addition to the indirect effect of anemia can occur as a result of iron absorption by the body. Factors that may affect the absorption of iron in the form of iron that is in effect on the absorption of food, organic acids such as vitamin C helps the absorption of iron so-notherm by changing the ferry into the ferrous form, which are polyphenols and tannins contained in tea, coffee, and some types of vegetables and fruits also inhibits the absorption of iron by way tie, phytic acid and other factors in cereal fiber and oxalic acid in vegetables inhibit the absorption of iron, the body needs iron greatly affect iron absorption, gastric acidity increase iron solubility, intrinsic factor in the stomach helps the absorption of iron, presumably because hem has the same structure with vitamin B12, which are polyphenols and tannins contained in tea, coffee, and some types of vegetables and fruits also inhibits the absorption of iron by means of tying.

It can be concluded that in pregnant women in the region of Banyumas Public Health Center with no anemia status more than most pregnant women with anemia status.

#### **The Correlation of Anemia Knowledge to Pregnant mothers and the incidents in Puskesmas Banyumas**

Based on Table, 5 this result is consistent with research conducted Rismiana (2005) on the

relationship of nutrition behavior of young women with anemia in Harapan High School Medan in 2005 which found that the knowledge and attitudes of respondents had no significant relationship with the occurrence of anemia. In addition to these studies there are other studies that disagree about the relationship of the level of knowledge and nutritional status on the incidence of anemia in adolescent for girls 3-grade student at SMAN 1 Tinambung Polewali Mandar where the results obtained in this study indicate that there is no significant relationship between knowledge of the incidence of anemia in young women ( $p = 0.258$ ). Other studies have reported similar results found in the study titled Relationship of maternal knowledge and consumption patterns with nutritional anemia in pregnant women in Public Health Centers kassikassi. The results of these studies are based on analysis result of the Chi-Square value obtained count = 0,000  $X^2 < X^2$  and  $r = 0.986 > 0.05$ . This suggests that there is no relationship between the incidences of maternal knowledge iron anemia in pregnant women.

Knowledge is the result of human sensing, or know someone on the results of the object through its senses (seeing, smelling, hearing and so on). By itself the sensing time to generate such knowledge is strongly influenced by the intensity of attention and perception of the object. Knowledge of anemia will assist in finding various alternative solutions to the problem of iron deficiency someone. Lack of knowledge of pregnant women about anemia in pregnancy can lead to a lack of iron-containing foods during pregnancy because it is basically the knowledge of maternal anemia is very useful for the mother alone in the iron-sufficient pregnant women.

In this study there was no significant relationship between knowledge and the status or the occurrence of anemia, because there are some things that can affect pregnant women not to suffer from anemia, not only from the knowledge of pregnant women but other factors such as distance before pregnancy to childbirth, many iron intake, nutritional status, and health status where the mother does not have a particular disease because there are some diseases that can affect the status of anemia such as worms, malaria and chronic diseases or congenital diseases also. It can be concluded that there is no relationship between knowledge of the status of anemia or anemia in pregnant women in the area of Public Health Center Banyumas.

## CONCLUSION

Knowledge of pregnant women on anemia in pregnant women in the area of Public Health Center Banyumas in 2012 achieved the highest is with moderate knowledge category. There is the incidence of anemia in pregnant women in the region of Public Health Center Banyumas in 2012 is less than the non-anemic. There was no significant correlation between maternal knowledge of anemia with anemia in pregnant women in the area of Public Health Center Banyumas in 2012.

## SUGGESTION

KIA Program Management and Nutrition in the Public Health Center is expected to do something to reduce the incidence of anemia in pregnant women in the area of Public Health Center Banyumas.

For the District Health office results of this study should be used as a reference and input in making a policy on the prevention and treatment of anemia in pregnant women.

## References

1. Almatier, Sunita. Prinsip Dasar Ilmu Gizi. Jakarta: Gramedia; 2009. h. 250, 253, 254.
2. Cunningham, F. Gary, Norman F. Gant, Kenneth J. Leveno, Larry C. Gilstrap III, John C. Haunt, Katharine D. Wenstrom. Obstetri Wiliam. Jakarta: ECG; 2006. h. 1463.
3. Dahlan, M. Sopiudin. Besar Sample Dan Cara Pengambilan Sample. Jakarta: Salemba Medika; 2010. h. 36-41.
4. Dep. Kes RI. Pusat Data dan Informasi Kesehatan Indonesia 2010. Jakarta: Kementrian Kesehatan RI; 2011. h. 38
5. Esse Puji, Sri Satriani, Nadimin, Fathiyatul Fadloyah. Hubungan Pengetahuan Ibu dan Pola Konsumsi dengan Kejadian Anemia Gizi pada Ibu Hamil di Puskesmas Kassi-Kassi. Dalam Media Pangan, Vol. X, Edisi 2, Juli-Desember 2010 (<http://jurnalmediagizipangan.files.wordpress.com/2012/04/9-hubungan-pengetahuan-ibu-dan-pola-konsumsi-dengan-kejadian-anemia-gizi-pada-ibu-hamil-di-puskesmas-kassi-kassi.pdf>) diakses tanggal 8 Agustus 2012.
6. Fresser, Diane M, Margaret A. Cooper. Myles Buku Ajar Bidan. Jakarta: EGC; 2009. h. 328, 329.
7. Hapzah, Ramlah Yunita. Hubungan Tingkat Pengetahuan dan Status Gizi Terhadap Kejadian Anemia Remaja Putri pada Siswi Kelas III di SMAN 1 Tinambung Kabupaten Polewali Mandar. Dalam Media Gizi Pangan, Vol. XIII, Edisi 1, 2012. (<http://jurnalmediagizipangan.files.wordpress.com/2012/07/hubungan-tingkat-pengetahuan-dan-status-gizi-terhadap-kejadian-anemia-remaja-putri.pdf>) diakses tanggal 8 Agustus 2012.
8. Hidayat, A. Aziz Alimul. Pengantar Kebutuhan Dasar Manusia-Aplikasi konsep dan Proses Keperawatan. Jakarta: Salemba Medika; 2009. h. 69
9. Manuaba, Ida Ayu Chandradinata, Ida Bagus Gde Fajar Manuaba, Ida Bagus Gde Manuaba. Ilmu Kebidanan, Penyakit Kandungan dan KB. Jakarta: ECG; 2010. h. 237, 238, 239, 240.
10. Marni, A. Retno M.S., Ery F. Asuhan Kebidanan Patologi. Yogyakarta: Pustaka Pelajar; 2011. h. 51.
11. Notoatmojodjo, Soekirdjo. Kesehatan Masyarakat Ilmu dan Seni. Jakarta: Rineka Cipta; 2007. h. 143-146.
12. Notoatmojodjo, Soekirdjo. Metodologi Penelitian Kesehatan. Jakarta: Rineka Cipta; 2010. h. 123, 126, 127, 176-179, 182-184.
13. Notoatmojodjo, Soekirdjo. Pendidikan dan Perilaku Kesehatan. Jakarta: Rineka Cipta; 2007. h. 121-122.
14. Saifudin, Abdul Bari, dkk. Buku Acuan Nasional Pelayanan Kesehatan Maternal dan Neonatal. Jakarta: JNPKKR-POGI; 2009. h. 89, 90, 91, 281.
15. Tarwoto dan Wasnidar. Buku Saku Anemia pada ibu hamil. Jakarta: Trans Info Media; 2007. h. 30, 38, 39, 60, 61.

## THE IDENTIFICATION BACTERIA *Streptococcus Pneumoniae* IN THE AIR ROOM PAUD IN SEBERANG ULU 1 PALEMBANG

**Heri Shatriadi, Zairinayati, Hoetary Tirta Amalia**

Lecturer Environmental Health of Science Diploma Degree Muhammadiyah Palembang

Email: zairinayati@yahoo.co.id/0852-67237274

### **Abstract**

*Air elements that is very important for human life, without any air human is not able to survive. The ventilating in room will make it easier for the movement air, from the outside space will go into the room, so that there was a change air. Quality of air principles in the room often cause problems in its occupants as headache, sore throat dried up, eye irritation and skin, lose concentration, acute respiratory tract infections. Microorganisms in the air pollution is a significant element which is very important as the main cause symptoms various illnesses, such as eye irritation, skin, upper respiratory tract and other therapy manual for patients with the other. Pneumoniae is acute bronchi infection disease that attacks the lungs caused by microorganisms. The disease is very vulnerable against children. In general disease caused by bacterial Streptococcus. Streptococcus Pneumoniae normally in the abdominal cavity is nose and throat children and adults healthy. Streptococcus Pneumoniae, also known as pneumococcus, is positive gram bacteria, dienkapsulasi recognized as the main cause important pneumoniae, meningitis and sepsis around the world. The purpose of this research is to identify the bacteria Streptococcus pneumoniae at age children education air room for PAUD which is in the region Seberang Ulu Palembang 2013. The population in this research is throughout PAUD which were Seberang Ulu 1 Palembang, sampel have to be delivered is amount 42, and the total population that is still active, taken purposive random sampling method with amount 11 of samples. Based on the lab had been found that out of the 11 PAUD was researched found a positive bacteria's Pneumoniae.*

**Keywords:** *Streptococcus Pneumoniae, Pneumoniae, PAUD (early childhood education)*

### **INTRODUCTION**

Air is also an element that is very important for human life, without any air human is can not to be survive. The ventilating in room will make it easier for the movement air, from the outside space

will go into the room, so that there was a change air. Quality of air principles in the room often cause problems in its occupants as headache, sore throat dried up, eye irritation and skin, lose concentration, ispa and declining work achievement or what are usually referred to as "sick building syndrome" (Baechler, 1991).

But the fact that they are now that the air in and around we have eased purity level because along with the development of days and as well as activities man so many resources contaminating air pollution that good tridacna and biology.

Microorganisms in the air pollution is the key element which is very important as the main cause symptoms various illnesses, such as eye irritation, skin, acute respiratory tract infections (ISPA) with and other therapy manual for patients with. A similar microorganism can be in the air through various ways mainly from a tiny dust scattered about. Dust that contain micro-organisms such as coming from ground, raw sewage animal/man and waste material. Animal Manure/man and other waste material (Moerdjoko, 2004).

Pneumoniae is acute bronchi infection disease that attacks the lungs. This disease vulnerable against children. In general disease caused by bacterial pneumoniae still next to it, nini *Streptococcus. Streptococcus Pneumoniae* normally in the abdominal cavity is nose and throat children and adults healthy. It is not all individuals will suffer from this disease, but in one's body has already happened colonisation bacteria, and he will be messengers and disseminator disease through air particles, for example when sneeze or cough and contact the body. *Streptococcus Pneumoniae, also known as pneumococcus*, is positive gram bacteria, dienkapsulasi recognized as the main cause important pneumoniae, meningitis and sepsis in around the world (indonesian ministry of Health, 2004;machmud,2006).

Pneumoniae is a imflamation caused by various etiology such as bacteria, viruses, fungi and foreign object (ngastiyah, 2005). According to muttaqin (2008) pneumoniae inflammation process is severe hepatic impairment lung that there are statements and filling and by eksudat that caused by

bacteria, viruses, and things to foreign matter that cause lung inflamed. Air sacs in the lungs, called and filled with pus ability to absorb and balance so that oxygen to be less. Lack of oxygen to make the body cells cannot work. This is, that cause infection spread throughout the body, patients with pneumoniae can die.

Pneumoniae had dubbed as a murderer page under five in Indonesia. This refers to the death at the end of this year from pneumoniae 2000 which reached five cases among children under five, it means that 1000 pneumoniae caused by 150 thousand children under five die each year or as many as 12,500 victims per month or 416 cases per day or 17 per hour or a toddler every five minutes (silalahi, 2004).

Household health according to a recent survey result, the death of infants in 2001 from pneumoniae 5 per 1000 children under five per year. This means that pneumoniae resulted in the death of more than 100,000 children under five every year or almost 300 children under five every day or 1 children under five every 5 minutes. Around 80%-90% of death was due to pneumoniae. Average mortality rate among children under five because pneumoniae caused handling of the disease pneumoniae very important. This condition was recognized by the government in order to eradication program ISPA has delineated to reduce the number of deaths among children under five from pneumoniae from 5/1,000 children under five in 2000 to 3/1,000 children under five in 2005 and reduce the figure hardships pneumoniae toddlers of 10%-20% for children under five in 2000 to 8% - 16% for children under five at the end of 2005. At the end of 2007, and then targeted five who suffer from the discovery that coverage pneumoniae by 66% and at the end of 2011 was 100 percent. Target coverage for children under five with pneumoniae that dealt with in 2007 with year 2011 period of 100% confirmed 2004). Number of cases ispa in the community expected 10 percent of the population. Target range ispa program at national pneumoniae among children under five of 76% of the estimated number of cases, but at the end of 2008 coverage finding new cases reached 18.81 percent, the health department 2009).

Here the authors assume that the bacteria *Streptococcus pneumoniae* is very dangerous for the body even though these bacteria is flora normal but have a great danger when a body's immune system decreased and make these bacteria to grow faster. In addition, I also think that the air have important role as the growth of bacteria and as we know that the air is main needs for biodiversity research that is used to breathe air directly related this to the body Beings live. For example, nurvita 2012 find staphylococcus aureus bacteria in the living room inpatient hospital in the Central Java city of Semarang and x Laila, 2008 found dirt form biological mold in the room university library x. The basic assumptions lead writer to the question as follows how the bacterial pneumoniae in streptococcus air in classroom education for young (PAUD) that were in the city Palembang. The purpose of this research was conducted to identify the presence of the bacteria Streptococcus pneumoniae in room air of PAUD in the area of Seberang Ulu Palembang in 2013.

#### RESEARCH METHOD

Design or that used in this research is descriptive analytic, because only describe this research on the bacteria *Streptococcus pneumoniae* in air room PAUD with how to carry out an investigation in the laboratory.

Based on secondary school Education Department of PAUD in Seberang Ulu Palembang is amount 42 PAUD, but that is still used and there was teaching and learning process as much as 23 PAUD and that an investigation *Streptococcus bacterial pneumoniae* as many as 11 PAUD, could not be checked because it is not that country be prepared the management to be an examination for various reasons, however, amount of sample that one investigated just represents because more than 50%.

#### RESULTS AND DISCUSSION OF RESEARCH

By the laboratory result against the bacteria *Streptococcus pneumoniae* can be seen in table below:

Table 1. Streptococcus bacteria Examination Results

No	Sample name and number of students	The investigation	
		Positive	Negative
1	The classroom Paud-A (40)		√
2	The classroom Paud-B (50)		√
3	The classroom Paud-C (70)	√	
4	The classroom Paud-D (50)	√	
5	The classroom Paud-E (30)		√
6	The classroom Paud-F (40)	√	
7	The classroom Paud-G (40)	√	
8	The classroom Paud-H (50)	√	
9	The classroom Paud-I (70)	√	
10	The classroom Paud-J (70)		√
11	The classroom Paud-K (50)		√

Based on table can be seen that basically number of PAUD who was investigated and there are positive bacteria *Streptococcus pneumoniae* as much as 6 PAUD (54.5%) and a negative bacteria *Streptococcus pneumoniae* as much as 5 PAUD (45.5%).

From the table above can be seen that the number of students teaching and learning processes that make the identified positive enough that PAUD C (70 students), PAUD D (50 students), PAUD F (40 students), PAUD G (40 students), PAUD H (50 students) and PAUD I (70 students).

From the investigation against 11 classrooms PAUD education that is in Beyond Ulu (destinated Kertapati and Plaju) it is known that there are 6 PAUD (54.5%) that there are positive bacteria *Streptococcus pneumoniae* in air classrooms and 5 PAUD (45.5%) that there is a negative bacteria *Streptococcus pneumoniae* in air classrooms. Bacteria *Streptococcus pneumoniae* is bacteria that normally nasal cavities in there and throat children and adults healthy, the bacteria was out when the children or adults sneezing or coughing. Dusty wind can carry bacteria *Streptococcus pneumoniae* spread widely, especially if room there are many children, for main source bacteria are respiratory man.

The entry dust into the classroom PAUD due to physical conditions price PAUD building a positive bacteria *Streptococcus pneumoniae* does not meet the requirements buildings healthy from observation is known that area and potentially ventilation as the air circulation and adding oxygen is not good and able to reproduce bacteria tend to be a good way, in addition, high and hygiene ceiling is also very not support a learning environment that is healthy. And cleanliness of the room lighting factors also show a room that is not

healthy proved to be the result of observation room was not given artificial lighting (only rely on natural lighting) but because the position room was among the building houses that light alamipun hindered. Even so, with cleanliness tables, and floor room that is very dusty streets. This is what has triggered a growing bacteria.

Bacteria *Streptococcus pneumoniae* is one of the disease-causing pneumoniae not single cause, pneumoniae can only caused by viruses, fungi and protozoan-deoxygenate. Pneumoniae is a disease respiratory under acute where some important factors known a defense mechanism is influence lung, colonisation bacteria in respiratory tract and cleaning material becomes noninfectious.

Although disease pneumoniae had been there was a program of the ministry of health to Eradicate Diseases program updates the surge in acute respiratory infections, but this disease is still a challenge for serious medical world. Prevention of disease is also expected to be carried out by the community in order to prevent diseases was especially in children under five. A number of studies conclude that physical environment house (in this building) that did not meet the requirements is a risk factor of the occurrence of pneumoniae among children under five. Thus, preventive effort pneumoniae should pay attention factors physical environment house. The House is a necessity for every man furthermore clothing and food prices.

## CONCLUSION

From 11 PAUD education that is examined it is well known that there are a positive 6 PAUD contaminated with bacteria *Streptococcus Pneumoniae* that PAUD C, PAUD D, PAUD PAUD F, G, H, PAUD PAUD I.

## SUGGESTION

### 1. For Institutions

It is advisable to do further research related to the bacteria, in order to know the impact on health care for children.

### 2. For Location or (Manager PAUD)

It is advisable to implementing a room (hygiene kits, Lighting, humidity, ventilation) to be cleaned regularly so that does not trigger growth of bacteria *streptococcus pneumoniae* and the bacteria are also able to multiply.

## References

- Basically Muttaqin. *Nursing client service system disorders fluids*. Jakarta.2008.Egc
- Baechler, Mc Et Al, also *Trigger Building Syndrome:Source, Health effects, Mitigation*, New Jersey: Noyes Data Corporation. 1991.
- The Ministry of Health guidelines, 1993, respiratory tract Infectious Disease Eradication Acute Health workforce, Jakarta, the Directorate-General PPMPLP.
- The Ministry of Health, 2005, *Working plan National Medium-Term in combating therapy manual for patients with Children Under Five in 2005-2009*.
- Emmy Bima Astuti Puji Lestari<sup>1</sup>, et al, *diversity and difference species of bacteria bacteria Air In The classrooms in SMK Theresiana Semarang*, Unimus Semarang.
- Heda Melinda Nataprawira d, 2006, *factor at risk present morbidity and mortality pneumoniae Weight in Children age Children Under Five*.
- Joviana, 2009 *Relations activities include Radon And Thoron In the Air In the room With symptoms also Trigger Syndrom In Building 3 dkijakarta*.
- Kartasasmita CRSP JAMKPI, 2004, *million died due to Illness ISPA, Bandung People thinking*.
- Laila Fitria, Ririn Arminsih Wulandari, Ema Hermawati, Dewi Susann. *The Department of Health Environmental, Health Faculty community*, University of Indonesia, Depok 16424, Indonesia.
- Machmud Rizanda, 2006 *pneumoniae Among Children Under Five In Indonesia And The Role In Tackling District*. Jakarta. Andalas University Press.
- Moerdjoko, 2004. *Connection System Ventllasi buildings With The Micro-organisms*.
- Makara, *Health*, Vol. 12, No. 2, December 2008: 77-8377. *Air quality In the Library of "X" In terms of quality Biology, Physical, Chemical and*
- Mardjanis, S, 2006, *To know what pneumoniae, Unfortunately baby, This June, De Vol. 5 No. 11*).
- Ngastiyah, 2005, *child care Hospital*. 2nd Edition, Egc, Jakarta.
- Biribo SS, Selvaraj G, Oppedisano F, Warren's, Seduadua A, et al. *As a bacterial vaginosis (about medium, citrated hair sheep blood that is a practical alternative to citrated human blood so that in laboratories in developing countries*. J Clin Microbiol. 2006;44:3346-3351.
- Silalahi, *ISPA and pneumoniae*, 2004
- S. Sulistyowati, R, *the relationship between the household Healthy with Genesis ISPA Among Children Under Five in Trenggalek District*, 2010.
- Streptococcus Pneumoniaee*. *Todar's online textbook of microbiology*. [Homepage on internet]. [Cited 2011 Dec 11]. Available from <http://textbookofbacteriology.net/s.pneumoniaee.html>
- Yuwono TA, 2008, *the factors that Physical Environment House that related to This incident pneumoniae in Children Under Five in the Community Health Center Kawunganten Cilacap Regency*, Diponegoro University, Semarang.
- Yeh E, Pinsky BA, Banaei N, Baron EJ. *Hair sheep blood, citrated or defibrinated, fulfills all requirements of blood in order for diagnostic microbiology laboratory tests*. PLoS One. 2009;4(7):e6141.
- Zuraidah, S, 2002, *the risk of pneumoniae in relation to Children Under Five house type in the Community Health Center Sidorejo Lor and Cebongan Salatiga*, Medical Journal Environment, Vol. 1 No. 2



**THE DIFFERENCE ACCURACY APPRAISAL WEIGHT EMBRYOLOGY IN  
RISANTO METHOD AND USG WITH WEIGHT BABIES WERE BORN  
IN A HEALTH CLINIC TEGALREJO 2009**

**Marlin, Riska**

Lecturer' Midwife) f Science Diploma Degree Muhammadiyah Palembang  
www.riska.okatavery@yahoo.co.id/0852-67280562

**Abstract**

*Measurements Accuracy Appraisal Weight Embryology in Risanto method and USG with Weight Babies Born in the Community Health Center has Tegalrejo in June and July 2009 in the Community Health Center Tegalrejo Yogyakarta. This research aims to know the difference accuracy appraisal weight Embryology in Risanto method and USG weight to the fetus time was born in the Community Health Center Tegalrejo. Types of research is observational approach with prospective cohort. Subjects or is a mother who has entered at that time I delivery that were in the living room deliver a health clinic Tegalrejo as many as 50 people. Data Collection be done by measuring Afterwards, dr. advanced fundus calculated with equation Risanto and USG examination and weight of newly born baby. Analysis of using tests statistic paired test and trial Anova with equal significance 0.05. Results of the study showed that There is no difference between a significant weight measurement appraisal fetus by using methods to Risanto weight newly born baby (t importers - 1.540). Measurements by using USG also shows there is no difference that a significant weight newly born baby (t importers -0.229). Counting result according to the method Risanto USG and there is no difference between the decreasing between the two methods in menaksirkan weight fetus (F importers methods risanto 2.563 and importers USG 0.014) with  $p < 0.015$ .*

**Keywords:** *measurements Appraisal Weight with the method fetus Risanto, USG and Body Weight newly born baby*

**Reference List:** 26 (1992 – 2009)

**INTRODUCTION**

Pregnancy inspection is an important role in efforts to prevent early detection congenital disease and her mother and baby. According to results of research done by Korokuin and Rimm (2003) in low-risk pregnancy, pregnancy inspection visit to reduce the amount of or USG will be done regularly

cannot be predicted maternal and perinatal outcome.

At the global can be estimated that the number of maternal death world in 2000 reached 529 thousand that spread in Asia 47.8 percent (253,000), Africa 47.4 percent (251,000), Latin America and Carribean 4 percent (22,000) and less than 1 percent (2500) in the developed countries. (Riza, 2006).

Based on data from The survey Democracy Population Indonesia (SDKI) in 2005 The mother's mortality rate (AKI) is estimated to reach 262 per 100,000 live births and at the end of 2006 reached 253 per 100,000 live births. The Government has been determined to reduce mortality rate from 390 per 100,000 live births to 225 per 100,000 in 1999, and let him down again to 125 per 100,000 in 2010 (the health department 2002).

Mother mortality rate in the Special Territory of Yogyakarta reached 110 per 100,000 live births in 2005, 107 per 100,000 live births in 2006, and reached 105 per 100,000 live births at the end of 2007. Government targets Yogyakarta Special Region, at the end of 2012 troubleshoots Mother mortality rate reached 87.5 per 100,000 live births. (Suyono, Haryono, 2008).

Research done by Siwono in 2005 that the majority (60-80%) maternal mortality caused by bleeding during childbirth, labor crunch, sepsis, high blood pressure in pregnancy and complications from abortion is not safe. Pregnancy Complications/delivery or that caused the death estimated previously mother could not be, and often happened several hours or days after birth.

The fetus know growth and intrauterine is how diagnosis is good to reduce the maternal and perinatal, where in low birth weight and birth weight too great a risk factor screening need to achieve optimal result during pregnancy. Diagnosis that very needed is at the time will experience birth process, where the assessment body weight fetus (TBJ) can be estimated that prognosis delivery and prognosis baby after being born. Weight Estimated the fetus can be done in such a way modern and simple. (Nurafriani, 1999).

The count Appraisal Weight fetus by using equations Johnson-Tausak less proper used because the formula was derived from other countries on the white population. So if it is applied in the country, there will be a variety that is quite big because it might due anthropometric from pregnant women or physical condition that is also different from that pregnant women where the formula comes (Siswosudharmo, 1991).

According to research done by Siswosudharmo (1991) provided by variety that is big enough to measuring result Afterwards, Dr. Fundus to get The assessment Body Weight fetus from pregnant women in Indonesia, which was at Sardjito has done. With the reason was then sought alternative solutions to problems with a new formula that would be suitable to be applied in Indonesia or for pregnant women race Melayu. In a research has higher were done is obtained a common ground regression analysis. The Line Regression Analysis is expected to replace the formula Johnson in calculating the fetus Appraisal Weight for the race Malay Indonesia.

Based on a preliminary study carried out by researchers on February 14, 2009 in Puskesmas Tegalrejo, researchers find that the amount of labor in 2007 as many as 680 and in 2008 as many as 682 people. The number of labor in January to 14 February 2009 as much as 53 labor. The number of expectant mothers who checked her pregnancy with ULTRASOUND as many as 56 people. Every expectant mother with aterm coming in at the clinic included in initial screening Tegalrejo performed an ULTRASOUND and found that there were 20 people (16.5%) occur with fetal weight estimates the weight of babies at birth.

Based on preliminary study above, the authors are interested in knowing the accuracy of measurements of Fetal Weight Estimates according to the method of Risanto and ultrasound with a newborn baby's Weight In Health Clinic Tegalrejo.

#### THE AIM OF RESEARCH

1. To know the average weight estimate measurement of results fetal according to method Risanto in Clinics Tegalrejo in July 2009.
2. To know the average weight estimate measurement of results fetal ULTRASOUND at Clinics according to Tegalrejo in June 2009.
3. To knows the average fetal body weight at the time of birth in Clinics Tegalrejo in July 2009.
4. To know the average fetal weight estimates difference according to the method of Risanto

with a weight of babies born in the time of clinics Tegalrejo July 2009.

5. To know fetal weight estimates difference according to ULTRASOUND the baby weighing Clinics is born in time Tegalrejo in July 2009.
6. To know the difference in average fetal weight estimates according to the method of Risanto and ultrasound with the weight of babies born in the time of clinics Tegalrejo in July 2009.

#### LITERATUR REVIEW

##### Definition Newborn

**Newborn** is a newborn was born in pregnancy is a new baby was born on the Moon enough pregnancy, baby's weight between 2500 to 4000 grams grams and signs of asphyxiation and other companion ailments as well as length of about 50 to 55 cm. Organ growth, scalp hair grows, the skin slick with verniks kaseosa or lanugo hair NET, grow well, testicles have descended into the scrotum, the Center expanded, penulangan mayus cover labium labium minus (Manuaba, 2002).

##### The Measurement Of Height Of The Fundus Uteri Method

One of the pregnancy monitoring is being performed is a measurement of the height of the fundus uteri. Fundus uteri height measurement above the symphysis pubis is used as an indicator of the progress of the growth of the fetus. TFU measurements can also estimate the gestational age is roughly. TFU measurements can help identify high risk factors. High stable or declining fundus can indicate intra uterin growth retardation, increased overload may indicate the existence of a twin pregnancy or hidramnion.

TFU can be measured in several different ways. Engstrom and Sitller wrote the history of the measurement of TFU from 1752 until now clearly. There are four measurement methods

##### 1. The method I

Determine TFU by linking simfisis pubis umbilikus women, and the ends of prosesus xifoid and using wide audit finger as measurement tools.

Ignorance akuratan this method:

- a. Women vary at a distance simfisis pubis to prosesus xifoid, location umbilikus among 2 point (imaginary) today.
- b. Big toes supreme audit Agency varies between fat and the thin.

##### 2. The method II

This method using standard units Caliper. Caliper used to put one end to the edge over the ends simfisis pubis and another at the summit

Afterwards, dr.. Both ends is placed on the diameter of a abdominal. Size and read on the scale cm (centimeters) which is located at 2 the caliper met. Size estimated to be the same with weeks of pregnancy after around 22-24 Sunday.

The loss :

Rarely used because it is more difficult, more expensive, less practical brought, more difficult to read, more difficult used that ribbon surveyor

### 3. The method III

Tape measuring accurate method is probably the second measurements TFU after 22-24 weeks of pregnancy. Zero measuring tape is placed on the edge over simfisis pubis and measuring tapes were swept through the diameter of a abdominal until the summit. Read result on a scale cm, size that can be measured should estimated to be the same with the number of weeks of pregnancy after 22-24 weeks of pregnancy.

The loss :

- Less accurate than caliper

### 4. Fourth Method

Tape measuring method but their measurements are different. The Line zero measuring tape is placed on the edge over simfisis pubis in line abdominal, hands that others were placed at the bottom line Afterwards, dr., a ribbon index finger and placed among middle finger, measurements will be done to the point where the finger sandwich ribbon measuring stick. So ribbon measuring stick to abdominal only as far as the peak and then a relative straight to the point where was arrested by radius of the inspection, the vocal cords not exceed Maximum permitted slope value is anterior reasoning from Afterwards, dr..

The loss :

- Complicated, not practical

In addition the method above, the formula Mc. Donald can be used by some supreme audit Agency to strengthen the accuracy measurements TFU during second trimester and third. Calculations as follows

- $TFU \text{ (cm)} \times 2/7 \text{ (or } + 3.5) = \text{duration pregnancy in the month}$
- $TFU \text{ (cm)} \times 8/7 = \text{duration pregnancy in the week}$   
(Varney, 2004)

### The Method Risanto

Measurements appraisal weight fetus by using equations Johnson less proper use. The basic reason is the formula was derived from other countries on

the white population. So if it is applied in the country, there will be a variety that is quite big caused by the difference anthropometric from his mother during pregnancy or physical condition that is also different from that pregnant women where the formula Johnson was coming. Therefore sought to solve by looking for a new formula would be suitable to be applied in Indonesia or for pregnant women Malay race.

Siswosudharmo (1992) in a study that aims to create a curve high standards Afterwards, dr. fundus in pregnancy aterm so it is expected to be mencermikan malay race, And in the bottom line Siwosudharmo Afterwards, dr. mentioned that regression Yundus can be used for predicting weight fetus based on the line regression  $Y = 127,6x - 931.5$ , where Y = appraisal fetal weight in grams, x = Afterwards, dr. fundus in centimeters. From the measurement, the line regression analysis can be used to measure the assessment birth weight babies.

### Ultrasonography (USG)

Ideal for the investigation in the first trimester to the third. If possible, pregnant women are highly recommended to undergo USG examination.

USG can assess :

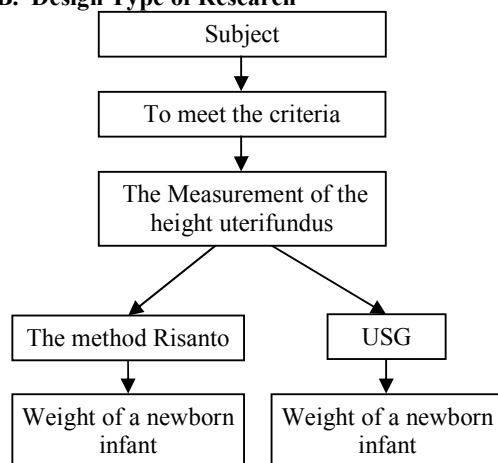
1. Bags gestasi: number, size, location, the form, the state
2. Janin: The life or death, the number of, presentation, expected age gestasi through biometri fetus (picture), the growth, congenital anomalies, and so on.
3. Umbilical Cord: amount of blood vessels, circulation (with Doppler can assess FDJP/ function Dynamic fetus placenta-SDAU/ arterial blood circulation Umbilikalis-picture)
4. The membrane/balance amnion: conditions, the number of
5. Placenta: location, the number of, size, hasten, insersi
6. The phimosi: ectopic pregnancy, mola hidatidosa, tumors, inkompetensia cervical cancer, etc. can also to help specific action : amniocentesis, fetoskopi transfusion intrauterin, a biopsy villus korialis.  
(Januardi, 2008).

### RESEARCH METHOD

#### A. Type of Research

Types of this research Observational approach with prospective cohort.

## B. Design Type of Research



Picture 1. Design

In the draft or inii done twice measurements appraisal weight fetus; that is, by using this method Risanto and USG. (Pre-test) and that the fetus measuring weight at the time was born.

## C. Population and Samples

### Population

The population is all her mother who is in the living room deliver a health clinic Tegalrejo Yogyakarta in June 2009.

### Sample

Samples this research is a mother who had been included in the 1 delivery that were in the living room deliver a health clinic Builder Palembang in June 2009 that meet the inclusion and exclusion on a number as criteria following

The criteria inclusion :

1. Age pregnancy aterm (39-41minggu)
2. Has entered the delivery
3. The baby in a single
4. A presentation

The criteria exclusion :

1. Mother inpartu with hidramnion
2. Mother inpartu with oligohidramnion
3. Mother inpartu with KPD

Samples taking a *non-Technical probability Sampling* is that it is a sample. Conform with samples taken at the time or took place in June 2009 with the criteria that has been determined by researchers. (Sastroasmoro, 2002).

Sample size is determined according to Dixon and B rep. Jim Leach where their trust in hypothesis test this research is 95 percent while ( $z\alpha = 1.96$ ) and strength (Power) trial 90% ( $z\beta = 1.26$ ). Number of mothers giving birth in 1 years, is 560 people, while the number of her mother in 1-month was 56

people, the number of sample that is required, it is as follows:

1. Determine percentage characteristics (P)  

$$P = \frac{\text{€ ibu hamil dalam 1 bulan}}{\text{€ ibu hamil dalam 1 tahun}} \times 100\% = \frac{64}{560} \times 100\%$$

$$P = 11,42\%$$

2. To Determine its Reversibility (V)

V =	$\sqrt{P (100-P)}$
=	$\sqrt{11,42 (100-11,42)}$
=	$\sqrt{11,42 \times 88,58}$
=	31,8

3. Determine the Number of sample

$$N = \left( \frac{ZV^2}{C} \right)$$

$$N = \left( \frac{1.96 \times 31.8^2}{10} \right)$$

$$N = 38.8 \text{ dibulatkan } 40$$

From the calculation of samples above can be determined sample size 40 respondents where one respondents two measurements are measuring the assessment body weight fetus by using this method Risanto USG and then the measurement of both done weight of weight babies time was born.

## D. Instrument or

Measurement tools that used

1. USG

This device is used to measure weight babies time was born in the unit gram.

Types of USG is Alloka brand.

Data Collection

Assessment dikamar deliver a health clinic Tegalrejo Yogyakarta with ways:

- a. Measuring the assessment body weight fetus mother inpartu with USG.
  - b. The measurement with USG will be done by the doctor General who took from obstetrics and gynecology specialists.
  - c. At the time, researchers' team measurement as assistant doctors assist USG.
  - d. After the measurement result obtained print out USG about the assessment body weight fetus.
  - e. Print out result was included in the table data collection.
2. Tape measure

A tool to measure Afterwards, dr. fundus measured from the side over simfisis pubis in centimeters and vesika urinaria empty

Measuring the assessment body weight fetus mother inpartu with tape measure, the result is calculated by the formula Risanto.

- a. Measurements appraisal weight fetus will be done by researchers or research team that is midwives working in the Community Health Center Tegalrejo Yogyakarta
  - b. Measurements appraisal weight fetus started with a medical check-up *Leopold*.
  - c. After the researcher checking *Leopold*, it is done measurement Afterwards, dr. fundus with tape measure.
  - d. Tape measuring method but their measurements are different. The Line zero measuring tape is placed on the edge over simfisis pubis in line abdominal, hands that others were placed at the bottom line Afterwards, dr., a ribbon index finger and placed among middle finger, measurements will be done to the point where the finger sandwich ribbon measuring stick. So ribbon measuring stick to abdominal only as far as the peak and then a relative straight to the point where was arrested by radius of the supreme audit Agency,
  - e. From the measurement result Afterwards, dr. fundus with tape measure, researchers measured the fetus appraisal weight by using equations Risanto namely
 

$$1276 \times \text{TFU (cm)} - 931.5$$
  - f. Counting result embodied in the table data collection
3. Weight babies  
Used to measure weight time was born in the unit in the unit gram.

Weight of done at the time the needle shows zeros

- a. Buyback weight of body weight fetus time born  
Weight fetus that weighed in the first hours after the baby is born, weighed without clothes using weight babies in the unit gram.
- b. Results weight of body weight included in the table data collection.

#### E. Data Analysis

In this research, analysis is done by doing average of between different measurements appraisal weight fetus by weight babies born with using tests comparative samples the trial statistics parametrik with t-test paired and test ANOVA with the assistance program computer SPSS 16.

Based on the table Distribution t with  $\alpha$  0.05 for testing the two t-table, if t -count higher than the t-table and H0 was rejected and H1 received. This means that there are differences between precision measurements appraisal weight fetus by using this method Risanto and USG with heavy badat time baby was born. Meanwhile, if t-count smaller than t-table is not there are differences between precision measurements appraisal weight fetus by using this method Risanto with USG to weight babies time was born. Counting result ANOVA said there are differences which means between Risanto method and USG estimated in weight fetus time was born when any  $< 0.05$  (was mentioned by Abbas Ghazali, 2001).

### RESULTS OF RESEARCH

#### A. The Distribution Respondent

Table 1. Number of giving birth normally in a health clinic Tegalrejo Yogyakarta in January-July 2009

No	Month	Number of delivery	Number of The investigation USG
1	January	53	46
2	February	42	42
3	March	60	26
4	April	61	78
5	May	64	98
6	June	51	83
7	July	50	41
Number of	381	414	

#### B. Hypothesis

Research was done on 50 subject or in the room deliver a health clinic Tegalrejo Yogyakarta.

To find out that there is a difference whether accuracy appraisal weight Embryology in Risanto method and USG with weight fetus time born" will

be used test-t or *t-test*. The hypothesis received when t count  $>$  from t table in equal significance  $\alpha = 0.05$ . Counting result t-test and ANOVA with using a program SPSS 16 as follows:

Table 2. Average value measurements Appraisal weight Embryology in Risanto method

No	Afterwar ds, Dr. Fundus	The assessment Body Weight Embryology in Risanto	N
1	27	2514	3
2	28	2641	3
3	29	2769	6
4	30	2897	12
5	31	3024	7
6	32	3152	4
7	33	3279	5
8	34	3407	10
Number of			50
Mean (an average)			3021.64
Standard deviation			273.321

Table 3. Average value measurements Appraisal weight According to the fetus USG and Body Weight newly born baby

No	The assessment Body Weight Embryology in USG	N
1	2000 - 2499	7
2	2500 - 2999	19
3	3000 - 3499	19
4	3500 - 3999	5
Number of		50
Mean (an average)		2964.44
Standard deviation		461.335

Table 4. value of Average weight measurement Appraisal fetus According to USG and Body Weight newly born baby

No	Weight newly born baby	N
1	2000 - 2499	2
2	2500 - 2999	24
3	3000 - 3499	20
4	3500 - 3999	4
Number of		50
Mean (an average)		2951.00
Standard deviation		334.342

Three Of The table above show that on average these weight the fetus that was born of 2951.00 grams with standard deviation of 334.342 gram, while average weight Embryology in the assessment method of Risanto 3021.64 grams with standard deviation of 273.321 gram and appraisal weight according to the fetus USG is 2964.44 with standard deviation of 461.335.

Statistical measurement result appraisal weight with the method fetus Risanto value of

average have (mean) that higher than in compare with measuring result by using USG. Seen from Advanced standard deviation both methods measurements appraisal weight fetus, obtained by the standard deviation measuring result by using USG higher than the standard deviation by using this method Risanto. This means, measuring result appraisal weight fetus by using USG variations that is very big.

Table 5. The difference price estimate weight Embryology in Risanto method to Weight newly born baby based on trial t-test paired samples

Variable	t count	T table	<i>R</i> (correlation)	<i>P</i>
The assessment body Weight Embryology in Risanto method to Weight newly born baby	-1.540	2.021	0.445	0.130

Table 5 in the count with test t-test paired obtained by the t count of - 1.540 to 0.130 significance. The t table in equal significance  $\alpha = 0.05$  is 2.021. Thus the t count < from t table, and the value any  $p = 0.13$ , where the value is ( $p > 0.05$ )

then these results show a  $H_0$  was rejected, it means there is no difference between the measurement significantly appraisal weight fetus by using methods to Risanto weight babies time was born.

Table 6. The difference price estimate weight According to the fetus USG to Weight newly born baby based on trial t-test paired samples

Variable	t count	T table	<i>R</i> (correlation)	<i>P</i>
The assessment body Weight Embryology in USG to Weight newly born baby	-0.229	2.021	0.495	0.820

Table 6 in the count with test t-test paired obtained by the t count of -0.229 to 0.820 significance. The t table in equal significance  $\alpha = 0.05$  is 2.021. Thus the t count < from t table, and the value any  $p = 0.820$ , where the value is ( $p > 0.05$ )

then these results show a  $H_0$  was rejected, it means there is no difference between the measurement significantly appraisal weight fetus by using USG to weight babies time was born.

Table 7. The difference between The assessment body Weight Embryology in Risanto method and USG to Weight newly born baby based on trial Aova

No		F count	Sig. (P)
1	The assessment body Weight Embryology in Risanto method to Weight newly born baby	2.653	0.019
2	The assessment body Weight Embryology in USG method to Weight newly born baby	3.550	0.014

Table 7 shows that the F count in the measurement appraisal weight fetus by using this method Risanto is 2.653 while any value is 0.019 ( $\text{sig} < 0.05$ ) and the F count in the measurement appraisal weight using USG of 3.550 with any value is 0.014 ( $\text{sig} < 0.05$ ) that  $H_0$  rejected this means that in the two methods is not there are differences are significant in the fetus menasirkan weight time was born, so that these two methods can be used to measure the assessment body weight fetus time was born.

## DISCUSSION

Measurements appraisal weight fetus accurately is difficult, because there is no measurement tools that almost the same for expected during the period accuracy checks

antepartal. Afterwards, dr. measurement fundus in determining weight babies were born with each other because each inaccurate way depending on the audit to determine the top Afterwards, dr. correctly.

Research has been done by Siswodharmo (1992) that measurements appraisal weight fetus by using this method Risanto higher in accordance with the population Malay race that by using equations Johnson Tausak who came from other countries that are very high accuracy used in white population. From the result of the research was that the correctness of Risanto method of 78.67 percent while according to the formula Johnson was 38.67 percent.

Research done by Nurafni at the end of 1992 Dr. Sardjito Yogyakarta is comparing measurements appraisal weight fetus by using this

method Risanto and methods Johnson Tausak. And this research also shows that a correlation between weight babies with the measurement appraisal weight with the method Risanto Embryology in more than a correlation between weight babies born with the method Johnson Tausak, this means that the measurement appraisal weight fetus by using this method Risanto can be trusted to replace the assessment measuring weight fetus by using this method Johnson Tausak.

Research done by Nilda Sinta Goddess at the end of 2004 using methods Johnson Tausak obtained hasinya where the assessment measuring weight fetus by using this method Risanto and Johnson Tausak there have been no significant difference in interpreting weight fetus time was born that both methods can be used to interpret weight fetus time was born.

Thus research result is the same as the previous several research which concluded that there is no difference between the measurement hugely significant weight with the method fetus Risanto and USG to weight newly born baby.

## CONCLUSION AND SUGGESTION

### Conclusion

Based on the results of research and discussion in this chapter before all can be concluded that:

1. There is no difference between a significant weight measurement appraisal fetus by using this method Risanto and USG weight to the fetus time was born.
2. Price measurement result appraisal weight Embryology in Risanto method is 3021.64.
3. Price measurement result appraisal weight according to the fetus USG is 2964.44.
4. Average weight babies were born time is 2951.00.
5. Result of the measurement appraisal weight fetus by using this method Risanto and USG not significantly different weight babies born with the t-test count Risanto method of  $t = 1.540$  and the value of any  $0.130$  or  $> 0.05$  while the t-test count USG of  $-0.229$  and values any  $0.820$  or  $> 0.05$ .
6. In principle both methods this can be used in measuring the assessment body weight fetus since there is no distinction between these two methods with any F Risanto method of  $0.019$  and any F USG of  $0.014$  or  $< 0.05$ .

### Suggestion

1. Midwife good in the Community Health Center Tegalrejo

In order to detect the possible complications in childbirth because they do not detected weight newly born baby so researchers suggested that always measuring Afterwards, dr. fundus in determining the fetus assessment body weight, both by using methods as well as Risanto USG.

2. Midwife private practice

Afterwards, dr. measurement fundus is a procedure midwifery that is very important in reducing morbidity and mortality perinatal mainly to find out growth and development fetus in pregnancy. Thus, a researcher suggested to set up a procedure remained for measuring Afterwards, dr. fundus in studying data in the mother deliver as part of the effort to raise in the service in his practice for antenatal.

3. Advanced researcher

- a. In looking at the variables measurements appraisal weight fetus with USG is not often written appraisal weight babies so study data must be conducted in a comprehensive so that, a complete data.
- b. In doing measurements Afterwards, dr. fundus, should be done in a bladder empty to prevent measurements that are higher than that in fact.

### Reference

- Adriaansz, George. 2008. *Jaringan Nasional Pelatihan Klinik-Kesehatan Reproduksi*. Diambil pada tanggal 17 Februari 2009 dari <http://www.depkes.co.id>
- Astuti, Sri. 2007. *Prioritas Departemen Kesehatan*. Diambil pada tanggal 17 Februari 2009 dari <http://www.majalah-farmacia.com> vol.6 No.12
- Cunningham, Gant, MacDonald. 2002. *Obstetri William*. EGC, Jakarta.
- Datu, Razak. 2006. *Cacat Lahir Disebabkan Faktor Lingkungan*. Diambil pada tanggal 18 Februari 2009 dari <http://www.jmed.unhas.ac.id>
- Departemen Kesehatan. 2002. *Yang Perlu Diketahui Oleh Petugas Kesehatan Tentang Kesehatan Reproduksi*. Eds 1. Depkes, Jakarta
- Indriyas, Yasmin. 2008. *Pengukuran Tinggi Fundus Uteri*. Diambil pada tanggal 17 Februari 2009 dari [www.akbidypsdm.net](http://www.akbidypsdm.net)
- Januadi, Judi. 2008. *USG Akurasi Deteksi Kelainan Janin*. Diambil pada tanggal 17 Februari 2009 dari <http://www.americanpregnancy.org/sit.sehatgroup.web.id>
- Johnson, Ruth. 2005. *Buku Ajar Praktik Kebidanan*. EGC, Jakarta.



- Julianty, K., et all. 2006. *Perbandingan Akurasi Taksiran Berat Badan Janin Menggunakan Rumus Johnson Tohsach Dengan Modifikasi Rumus Johnson Menurut Syahrir*, Program Pendidikan Kedokteran Spesialis Obstetri dan Ginekologi. FK Unsri, Palembang.
- Lukas Efendi. 2005. *Peran USG Pada Deteksi Dini Kelainan Kongenital*. Diambil pada tanggal 17 Februari 2009 dari <http://www.med.unhas.ac.id>
- Manuaba, Ida Bagus Gde. 1998. *Ilmu Kebidanan, Penyakit Kandungan dan Keluarga Berencana Untuk Pendidikan Bidan*. Eds 1. EGC, Jakarta.
- Markum. 1992. *Ilmu Kesehatan Anak*. Eds 1. FK UI, Jakarta.
- Mustika, Sofyan., et all. 2006. *50 Tahun Ikatan Bidan Indonesia*. PP IBI, Jakarta
- Notoatmodjo, Soekidjo. 2002. *Metodologi Kesehatan*. Eds 2. Rineka Cipta, Jakarta.
- Nurafriani. (1999). *Taksiran Berat Badan Janin Antara Metode Johnson Tausak Dan Metode Risanto Di RSUP Dr. Sardjito*. Karya Tulis Ilmiah Program DIII Kebidanan. FK UGM, Yogyakarta.
- Prawirohardjo, Sarwono. 2002. *Ilmu Kebidanan*. YBP-SP, Jakarta.
- Riza. 2006. *Deteksi Dini Angka Kematian Ibu di Indonesia*. Diambil pada tanggal 24 Februari 2009 dari <http://www.med.unhas.ac.id>
- Roeshardi, Haryono. 2006. *Upaya Menurunkan Angka Kesehatan Dan Angka Kematian Ibu*. Repositiry disampaikan pada Pidato Pengukuhan Jabatan Guru Besar Tetap Universitas Sumatera Utara, Medan.
- Saifuddin, Abdul Bari. 2002. *Buku Panduan Praktik Pelayanan Kesehatan Maternal dan Neonatal*. YBP-SP, Jakarta.
- Sastroasmoro, Sudigdo. *Dasar-Dasar Metodologi Penelitian Klinis*. Binarupa Aksara, Jakarta.
- Sherrie, Jacquiline. 1998. *Keselamatan Ibu Keberhasilan Dan Tantangan*. Program For Appropriate Technology In Health, vol 16.
- Sintadevi, Nilda. 2004. *Perbedaan Rata-Rata Pengukuran Taksiran Berat Badan Janin Waktu Lahir Menurut Metode Johnson-Tausak dan Metode Risanto Dengan Berat Badan Waktu Lahir*. Karya Tulis Ilmiah Program DIII Kebidanan. Poltekkes Depkes, Yogyakarta.
- Sugiyono. 2008. *Statistika Penelitian*. Alfabeta, Jakarta.
- Suyono, Haryono. 2008. *Membangun Penduduk Sehat Dalam Era Desentralisasi Melalui Pemberdayaan Keluarga*. Makalah disampaikan pada Seminar Nasional Universitas Islam Indonesia Yogyakarta.
- Varney's. 2004. *Ilmu Kebidanan*. Sekeloa Publisher, Bandung.

## THE INFLUENCE OF EARLY BREASTFEEDING INITIATION TO THE DURATION OF LABOR THIRD PERIOD IN MATERNITY MOTHER AT AL- JARIYAH MATERNITY HOSPITAL PALEMBANG IN 2013

R. A. Aminah Maya, Citra Purwanti

Dosen Prodi DIII Kebidanan STIKes Muhammadiyah Palembang

### **Abstract**

**Background:** Indonesia has high number of maternal mortality and one of the causes is caused by postpartum bleeding. One of the way to prevent the bleeding is by doing early breastfeeding initiation that can stimulate utery contraction so that can make labor third period faster and decrease the bleeding labor. although the beneficiaries of early breastfeeding initiation have been known, but there are still many hospitals and others health service places haven't done early breastfeeding initiation.

**Objective:** the purpose of this research is to know the influence of early breastfeeding initiation to the duration of labor third period in maternity mother at Al-Jariyah Maternity Hospital Palembang in 2013.

**Method:** this study is an experiment research by using static group comparison of pra-experiment design. The location was in Al-Jariyah Maternity hospital Palembang. This research used early breastfeeding initiation as independent variable and duration of third stage of labor as dependent variable. The samples were 60 persons from population that fulfill the criteria. Data analysis used independent t-test to understand the effect of early breastfeeding initiation to the duration of labor third period.

**Result:** from 60 respondents, 30 persons (50%) being experiment group and 30 persons (50%) being control group and the average duration of labor third period for experiment group were  $6,10 \pm 1,67$  minutes and for control group  $9,73 \pm 1,89$  minutes. t-account (7.888) was higher than t-table (1.671) and p value = 0,000 ( $p < 0,05$ ) so  $H_0$  was unacceptable and it means that there was an influence of early breastfeeding initiation to the duration of labor third period in maternity mother at Al-Jariyah Maternity hospital Palembang in 2013.

**Conclutions:** There was an influence of early breastfeeding initiation to the duration of labor third period in maternity mother at Al-Jariyah Maternity hospital Palembang in 2013.

**Keywords:** early breastfeeding initiation, the duration of labor third period

### **PRELIMINARY**

Approximately 90% of maternal mortality occurred when childbirth and 95% of the causes of maternal mortality in the obstetric complications that often can not be predicted before. The direct causes of maternal mortality in Indonesia are caused due to bleeding, infection, and eclampsia are often known as the classic trias. The frequency of postpartum bleeding 4-15% of all causes of bleeding including bleeding and uterine atony (50% -60%), retained placenta (3% -4%), retensio placenta (16% -17%), lacerations of the birth canal (4% -5%) and blood disorders 0.5% -0.8% (Mochtar, 2005).

Maternal mortality and the newborn is not one thing that can not be faced, even largely preventable if people think their life is worth to be saved. Delivery and the prevention of complications Programme will encourage people to check their pregnancy, childbirth, postnatal care and treatment of babies born on skilled labor. Other efforts with complete tetanus immunization of pregnant women and the provision of any Early Breastfeeding Initiation or better known as Early Breastfeeding Initiation (Eko, 2008).

Early Breastfeeding Initiation benefits include reducing baby risk for experiencing hypothermia, mother and baby feel relax, breathing and heart rate more stable infants, babies cry less, thereby reducing energy usage, improve baby immunity to germs from the outside, the beat of the baby's head, hands touch the baby at mother's nipples, licking and sucking of baby will stimulate oxytocin hormone that will stimulate the uterus to contract and may reduce the risk of either bleeding or bleeding in the third stage or the fourth stage, and can improve the success of exclusive breastfeeding eight times more compared with infants who were not given Early Breastfeeding Initiation (Roesli 2008).

Researchers have conducted a preliminary study both of literature and of the results from a preliminary survey in six maternity hospital in

Palembang, but only 2 places just began to implement the Early Breastfeeding Initiation eventhough not entirely, namely Budi Indah maternity hospital and Al-Jariyah maternity hospital. Al – Jariyah maternity hospital as one of public health service centers with an average of 30-40 childbirth per month. For this reason, researchers interested in conducting research in order to find out the Early Breastfeeding Initiation for maternity benefits, especially in the duration of labor third period.

Formulation of the problem in this study is there was any influence of Early Breastfeeding Initiation to the duration of labor third period in maternity mother at AL – Jariyah maternal hospital in 2013 ?. The purpose of this study is generally known The Influence of Early Breastfeeding Initiation to the duration of labor third period in maternity mother at AL-Jariyah maternal hospital in 2013, and in particular is to know the average duration of labor third period in the maternity mother with Early Breastfeeding Initiation and without Early Breastfeeding Initiation. The advantage of research in practice is that it can be considered a midwife in order to enter the Early Breastfeeding Initiation as one of SOP aid maternity in the Aljariyah maternity hospital so it can continue improve the quality of maternity services in particular in the duration of labor third period, and theoretically expected to be used as information, especially in the field of midwifery to increase knowledge and insight about Early Breastfeeding Initiation with length duration of labor third period and bias useful as a reference for further research.

## RESEARCH METHODS

This research is a kind of experiment research, namely an experimental study that aims to identify a symptom or effect as a result of a particular treatment and the treatment is expected to occur from changes or influence on other variables (Notoadmodjo, 2005). This study uses the Pre design experiments with form static group comparison design, in which the experimental group received the treatment (Early Breastfeeding Initiation) which is followed by a second measurement or observation and the observation result is then controlled or compared with the results observed in the control group who did not receive the program or intervention (Without Early Breastfeeding Initiation). The population in this study were all maternity mother at AL-Jariyah maternity hospital in 2013. The total sample of this study were 60 maternity mother. This study used

purposive sampling is a sampling technique based on considerations specific determination made by the researchers themselves. In this study, 30 maternal obtained experimental group (With Early Breastfeeding Initiation) and 30 maternal control group (Without Early Breastfeeding Initiation), the inclusion criterias are the maternity mother and healthy babies who are able to do Early Breastfeeding Initiation including maternal labor actions (including delivery by vacuum, forceps).

The research was conducted at AL-Jariyah maternity hospital located at Ogan III street number 1224/1225 RT 20 RW 05 Sako residence, Palembang. The research was conducted starting on April, 7<sup>th</sup> to 15 July, 15<sup>th</sup> 2013. The variables of this research consisted of the independent variables, namely the implementation of the Early Breastfeeding Initiation and dependent variabel was duration of labor third period. Operational definition in this research: Early Breastfeeding Initiation is breastfeeding (breast milk) immediately after birth by way of a baby placed on the mother 's chest so that the baby will look and suck the nipple itself without coercion or help from others who carried out prior to the birth of the placenta were observed with the observation sheet, the scale of nominal data, can be divided into 2 categories, Early Breastfeeding Initiation and not Early Breastfeeding Initiation. The the duration of labor third period is birth of the placenta which expressed in minutes by the clock that is used in the maternal room is calculated from the birth of the baby until the birth of the placenta. The ratio of data scale, which expressed in minutes. The data collected directly from the respondent at the time of maternity at the AL-Jariyah maternal hospital as the experimental group that will provide treatment research (conducted Early Breastfeeding Initiation) and unconduted Early Breastfeeding Initiation as a control group. Researchers noted the results of the experimental group and the control group with respect to the old third stage in each group. the duration of labor third period.

The steps of research conducted that researchers provide an overview to the midwife at Al-Jariyah maternity hospital about activities will do to harmonize the implementation of research later, researchers in collaboration with the midwife at AL-Jariyah maternity hospital years to provide treatment and control group to observe duration of labor third period in the study sample, which was obtained after the subject inclusion criteria, sample for the experimental group treated with Early Breastfeeding Initiation be done for at least 60 minutes and the control group do nothing,

researchers and team record the results of treatment (post test) in the treatment group (experiment) and the control group in the observations, the data were analyzed to determine the influence of Early Breastfeeding Initiation to the duration of labor third period with a computerized system. The research instrument used is the instrument of the independent variables in the form of sheets or checklists and instruments observation of the dependent variable is in the maternity room wall clock AL-Jariyah used as a measuring device for measuring the duration of labor third period. Processing techniques and data analysis using statistical tests independent t-test with  $\alpha$  of 5% (0.05).

## RESULT AND DISCUSSION

### Result

Table 1. Frequency Distribution of Respondents by Implementating Early Breastfeeding Initiation (EBI) in Maternity Mother

EBI	n	%
Yes	30	50
No	30	50
<b>Summary</b>	<b>60</b>	<b>100</b>

From Table 1 above, shows that from the 60 respondents, conducted Early Breastfeeding Initiation were 30 people (50%) and do not do EBI were 30 people (50%).

Table 2. Frequency Distribution of Respondents with the duration of labor third period in maternity mother

Labor Third Periode (minute)	EBI	Not EBI	n	%
4	4	0	4	6,67
5	12	0	12	20
6	2	1	3	5
7	4	2	6	10
8	6	6	12	20
9	1	4	5	8,33
10	1	9	10	16,67
11	0	1	1	1,67
12	0	4	4	6,67
13	0	3	3	5
<b>Summary</b>	<b>30</b>	<b>30</b>	<b>60</b>	<b>100</b>

From Table 2 above shows that of the 60 respondents, who have duration of labor third period for 4 minutes by 4 people (6.67%), 5 min 12 people (20%), for 6 minutes as many as 3 people (5%), 7 minutes as many as 6 people (10%), for 8

minutes as many as 12 people (20%), 9 minutes by 5 people (8.33%), for 10 minutes as many as 10 people (16.67%), as many as 11 minutes 1 person (1.67%), for 12 minutes by 4 people (6.67%), 13 minutes as many as 3 people (5%).

Tabel 3. The Influence of Early Breastfeeding Initiation to the duration of labor third period in maternity mother

Labor Third Periode	EBI	n	Mean	SD	CI (95%)	t	P value
	Yes	30	6.10	1.668	2.711- 4.556	7,888	0.000
	No	30	9.73	1.893	2.711-4.555	7,888	0.000

From Table 3 above, the average duration of labor third period on maternal with EBI was  $6.10 \pm 1.67$  minutes, and the average duration of labor third period of the third stage of labor on maternal without EBI was  $9.73 \pm 1.89$  min.

## DISCUSSION

EBI is the beginning of early breastfeeding where the baby starts feeding itself soon after birth

that lasted until the first hour of birth. The duration of labor third period is a process that starts from birth and ends with the birth of the placenta (Varney, 2008). From the research results obtained, it is known that the average duration of labor third period in maternity mother with EBI was  $6.10 \pm 1.67$  min, whereas in maternity mother without EBI was  $9.73 \pm 1.89$  min. From the results of the statistical test using the Independent t-test, t

obtained 7.888, bigger than t table (1.671) which indicates that there is a significant difference for the duration of labor third period in maternity mother with EBI and without EBI. The significance level  $p < 0.05$  ( $p : 0.000$ ), and  $CI > 1$  (2.771 to 4.556) which means that  $H_0$  is rejected so it can be concluded that There was the influence of Early Breastfeeding Initiation to the duration of labor third period on maternity mother with EBI and without EBI. t count of 7.888 indicates that the duration of labor third period in maternity mother will be shorter if it's done by EBI. The results of statistical tests independent t-test showed that there was an influence of the implementation of the EBI to duration of labor third period. The hypothesis that there was influence of EBI to the duration of labor third period on maternity mother proved correctly.

This is consistent with the theory that supports the results of this research include the initial soft touch by the hand or the head of the baby, the baby's feet stamped on the mother's abdomen to stimulate production of the hormone oxytocin, the hormone which serves to stimulate uterine contractions that may affect the long expulsion of the placenta so as to reduce the risk of postpartum hemorrhage (Kusmarjadi, 2009).

Another theory that supports this research is the theory of Roesli (2008) which states that touch or pressure of the hand, and the head of the baby's mouth and sucking at the breast stimulates oxytocin production is important to stimulate uterine contractions, it can help reduce the bleeding placenta and Maternal.

The results of this research are also supported by previous researches which prove that there was the influence of early initiation of breastfeeding to the duration of labor third period on maternity mother in Al-Jariyah Maternity Hospital, Palembang.

The EBI is a new government program is realized on the Moon in August 2007 so not many midwife and other health workers who carry it out so that the existence of this research can provide motivation for midwife to always do the EBI.

There are many advantages of EBI include reducing the risk of infant mortality, succeed the exclusive breastfeeding programme, prevent hypothermia, increase the psychological relationship between the mother and the baby, and one of the important advantages and benefits of the implementation of the EBI is able to accelerate the delivery of the placenta. This is consistent with the results of this study there was a significant influence of EBI to duration of labor third period.

With the rapid delivery of the placenta and complete the bleeding during childbirth can be avoided, it can indirectly prevent and reduce maternal deaths in which the hemorrhage is still one of the major causes of maternal mortality in our country.

## CONCLUSIONS AND RECOMMENDATIONS

The results of this research concluded that : the average duration of labor third period in maternity mother with EBI in AL - Jariyah Maternity Hospital was  $6:10 \pm 1.67$  minute and the maternity mother without EBI was  $9.73 \pm 1.89$  minute, based on the statistical test using the Independent t-test was obtained t (7.888), greater than t table (1.671) which indicates that there is a significant difference to the duration of labor third period with EBI and without EBI, and it was found that the p value = 0.000 ( $p < 0.05$ ),  $CI > 1$  (2.771 to 4.556), it can be concluded that there was influence of EBI to the duration of labor third period in maternity mother.

Referring to the results of research that has been done, there were several suggestions put forward so it can be considered a midwife at the AL-Jariyah maternity hospital to maintain its commitment to implement the optimal EBI, making SOP implementation of the EBI, the EBI is committed to implement a series of aid delivery process, and provide health education and motivation in pregnant women during pregnancy to be willing to do the EBI at the time of delivery. For those willing to do for maternity mother EBI at the time of delivery in order to further strengthen the bond between mother and baby and can provide great benefits for the mother, especially to reduce the risk of postpartum hemorrhage, and for further research to continue to explore and examine other variables that affect the execution of EBI in some places so that health care can learn more factors that affect the implementation of the EBI.

## Bibliography

- Cuningham, FC, dkk. 2006. *Obstetri Williams*. Jakarta : EGC.
- Depkes RI, 2007. *Pedoman Pelaksanaan Pekan ASI se-Dunia*. Kementrian Negara Pemberdayaan Perempuan Indonesia. Jakarta
- Liu, T. 2008. *Manual Persalinan*, edisi 3. Jakarta : EGC.
- Manuaba, Ida Bagus Gde. 1998. *Ilmu kebidanan, Penyakit Kandungan dan Keluarga Berencana untuk Pendidikan Bidan*, Jakarta : EGC.

Proceedings of International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, December 28<sup>th</sup>, 2013

- Mochtar, Rustam. 1998. *Sinopsis Obstetri I*. Jakarta : EGC.
- Notoatmodjo, Soekidjo. 2005. *Metodologi Penelitian Kesehatan*, Jakarta : Rhineka Cipta.
- Roesli, Utami. 2008. *Inisiasi Menyusu Dini dan ASI Eksklusif*. Jakarta: Pustaka Bunda
- Saefuddin, Hanifa. 2006. *Buku Acuan Nasional Pelayanan Kesehatan Maternal dan Neonatal*. Jakarta : Yayasan Bina Pustaka Sarwono Prawirohardjo
- \_\_\_\_\_. 1997. *Issues in training for essential maternal healthcare in Indonesia*. Medical Journal of Indonesia Vol 6 No. 3
- Sugiyono. 2007. *Statistik Untuk Penelitian*, Bandung : CV Alfa Beta.
- Sumarah, dkk. 2008. *Asuhan Kebidanan Pada Ibu Bersalin*. Yogyakarta : Fitramaya
- Syafiq, Fika. 2003. *Hubungan Antara Menyusui Segera (Immediately breastfeeding) dan Pemberian ASI Sampai dengan Empat Bulan*. Jakarta : Journal Kedokteran Trisakti
- Varney, Helen, dkk. 2007. *Buku Ajar Asuhan Kebidanan*, edisi 4 volume 1. Jakarta: EGC
- \_\_\_\_\_, 2007. *Buku Ajar Asuhan Kebidanan*, edisi 4 volume 2. Jakarta: EGC
- Wiknjosastro, Gulari, dkk. 2008. *Asuhan Persalinan Normal*, Jakarta: JNPKR
- Winkjosastro, Saefudin, Biran Affandi. 2005. *Ilmu Kebidanan*. Jakarta: Yayasan Bina Pustaka Sarwono Prawiroharjo.

## CYTOTOXIC ACTIVITY TEST OF EXTRACT AND FRACTION OF GALANGAL (*Alpinia galanga*) ON HeLa CELLS BY IN VITRO

Puji Setya Rini, Irsan Saleh, Theodorus, Salni

[puji\\_ners86@yahoo.com](mailto:puji_ners86@yahoo.com)

Lecturer of Stikes Muhammadiyah Palembang

### Abstract

*The increasing incidence of cervical cancer and cancer treatment efforts have not been sufficiently developed that needs traditional treatment using galangal plants that has cytotoxic activity against HeLa cells. The purpose of this study was to determine the cytotoxic activity of extracts and fractions of galangal (*Alpinia galanga*) against HeLa cells by in vitro, comparing the cytotoxic activity of extracts and fractions of galangal (*Alpinia galanga*) with anti-cancer drugs doxorubicin and determine the class of compounds that have cytotoxic activity. Explorative experimental studies were carried out in the Post Graduate Laboratory of Sriwijaya University and Parasitology Laboratory, Medical Faculty, University of Gadjah Mada. The study was conducted on cultured HeLa cells with cytotoxic drugs doxorubicin, ethanol extract, ethyl acetate fraction, n-hexane fraction and ethanol fraction of liquid from galangal (*Alpinia galanga*). Cytotoxic activity test was performed by using the MTT method. Determination of the active class of compounds was performed by Thin Layer Chromatography (TLC) test. Observational data was tested by probit analysis to determine the IC<sub>50</sub>, followed by Post Hoc test to detect differences between the test materials. The test results showed galangal extract (IC<sub>50</sub> 92.648 µg/ml) and n-hexane fraction galangal (IC<sub>50</sub> 13.010 µg/ml) had cytotoxic activity against HeLa cells. And test results of doxorubicin with extracts ( $p = 0.000$ ) and doxorubicin with n-hexane fraction ( $p = 0.025$ ), showed there was a significant difference between the IC<sub>50</sub> values of doxorubicin with n-hexane extracts and fractions of galangal (*Alpinia galanga*). Conclusions from this research is that extracts and fractions containing the active compound of terpenoids were marked with purple*

*spots and a concentration of 1 µg/ml concentration of doxorubicin is equivalent to 8 µg/ml and the extract is equivalent to a concentration of 2.4 µg/ml galangal fraction (*Alpinia galanga*).*

**Keywords:** cytotoxic, galangal extract, galangal fraction, HeLa cell

### BACKGROUND

Cervical cancer is a malignant primary tumor derived from squamous epithelial cells. Cervical cancer occurs in the cervix or uterus, an area on the female reproductive organ of which is the entrance to the uterus, it is located between the womb (uterus) and the sexual intercourse hole or vagina (Notodiharjo, 2002). Cervical cancer usually affects women aged 35-55 years old. The incidence and mortality number of cervical cancer is on the second rank after breast cancer. Meanwhile in developing countries, it is still on top of the list as a cause of mortality by cancer in reproductive age (Rasjidi, 2007).

According to Rachmadahnar (2005), in 2000 there were approximately 80% of cervical cancer cases in developing countries, such as in Africa around 69,000 cases, in Latin America around 77,000 cases, and in Asia around 235,000 cases. In Indonesia, it occurred about 90 to 100 new cases of cervical cancer per 100,000 population per year (Ministry of Health, 2001). It was confirmed by research from Ayu and Pradjatmo (2004) who concluded that cervical cancer was the most gynecological cancers, followed by ovarian cancer.

Cancer treatment has not been quite satisfactory. This is due to the low selectivity of anti-cancer drugs used or the pathogenesis of cancer itself is not clear yet (Natural and Tayeb, 2003). Indonesia is a country with rich medicinal

plants that have the potential to be developed as an anti-cancer drug (Ahmad et al., 2008).

So that traditional medicine can be acknowledged, it is necessary to have scientific research of pharmacology, toxicology, identification and isolation of the active chemicals found in plants (Harmanto, 2003). One of the plants that are used by people as a traditional medicine is galangal (*Alpinia galanga*).

Galangal is included in the family *Zingiberaceae*, class *rhizome*, it is often used as a food seasonings or spices, has a fragrant aroma and spicy flavor. Besides flavoring, it is also used for traditional medicine, such as to treat gastric disorders, to eliminate bloating, anti-fungal, to eliminate itching, to increase appetite, to eliminate fever and sore throat (Widjaja, 2009). Galangal (*Alpinia galanga*) has active compounds such as saponins, tannins, flavonoids, and essential oils that are known to have the effects of anti-bacterial, anti-fungal, anti-oxidant, anti-inflammatory, anti-viral, anti-tumor, and so on (Depkes, 2006).

Rusmarilin (2003) proved the ethyl acetate extract of galangal inhibited cancer cell proliferation in both cultured cancer cells using flow and primary human cancer cells. Inhibition of cancer cell proliferation was measured by the number of living cells in culture by hemocytometer. The ethyl acetate extract of galangal 100 µg/ml inhibits 100% of lung cancer cell proliferation (A 549) and at a concentration of 50 µg/ml it occurred the lowest inhibition of 95%. At the concentration of 200 µg/ml the highest inhibition occurred in primary cancer cells from ovarian cancer and serous papillary adenocarcinoma of 76.36% and the lowest inhibition of 41.82% was obtained in concentration of 50 µg/ml.

Seeing the capabilities and chemical constituents of galangal, the galangan plant has potential as an phytopharmaca drug for anti-cancer treatment. Galangal (*Alpinia galanga*) has not been widely used by the public as an anti-cancer and more information about the bioactive material contained in galangal (*Alpinia galanga*) is widely unknown. Therefore it is necessary to separate the anti-cancer bioactive ingredients from galangal (*Alpinia galanga*) based on the degree of polarity to obtain the anti-cancer bioactive material and classes of active compound.

## LITERATURE REVIEW

### Cervical Cancer

Cervical cancer is a malignant primary tumor derived from squamous epithelial cells. Cervical cancer is a cancer that occurs in the cervix or uterus, an area on the female reproductive organ which is the entrance to the uterus, it is located between the womb (uterus) and the sexual intercourse hole or vaginal (Notodiharjo, 2002). Cervical cancer usually affects women aged 35-55 years. There is 90% of cervical cancers from squamous cells lining the cervix and the remaining 10% comes from the mucus-producing gland cells in the cervical canal leading to the uterus.

Munoz (2003) stated clearly that HVP was a major cause of cervical cancer. In 90.7% sample of cervical cancers from the patient found HPV DNA. DNA components of HPV viral had been detected in more than 90% lesions intarepitel squamous (LIS) and invasive carcinoma of the cervix uteri compared with a lower percentage obtained by the control (Garcia, 2007).

The most common symptom of cervical cancer is abnormal vaginal bleeding or spotting in vagina. Abnormal bleeding especially occurs after sexual intercourse, and can also appears between 2 period cycle, menorrhagia, or spotting / bleeding of postmenopausal. If the bleeding lasts for a long time, the patient may complain of fatigue and weakness due to anemia experienced. Watery yellowish patches followed by a fishy odor can be a sign of malignancy. Symptoms usually only appear when abnormal cells transform into malignant and infiltrate the surrounding tissues.

In later stages, patients may complain of smell vaginal spotting, weight loss, and obstruction (blockage) in urination. If the cancer has spread to the pelvic, back ache may occur followed by barriers in urination and hydronephrosis (enlarged kidneys). Symptoms of bladder or rectum (hematuria < bleeding urine), hematoschezia < bleeding defecate, fistula) may be associated with the spread to the bladder and rectum in invasive tumors.

### HeLa Cells

HeLa cell is cervical cancer cells from infection of Human Papillomavirus (HPV 18) so that it has different properties with normal cervical cells. Cervical cancer cell infected by HPV is



known to express 2 oncogene, namely E6 and E7. E6 and E7 proteins have shown to cause immortality in primary culture of human keratinocytes, but these immortal cells are not tumorigenic until a genetic process occurs. Thus, the viral oncogenes do not directly induce tumor formation, but induce a series of processes that ultimately can lead to cancer properties (Goodwin and DiMaio, 2000).

### Sitostatica

Sitostatica is substance that can stop the rapid growth of malignant cells. Generally anti-cancer works based on interference with one of the essential cell processes. All anti-cancer disturbs normal cells because of the absence of qualitative differences between cancer cells with normal cells. Anti-cancer is cytotoxic and not cancerous, or cancerotoxic selective, as well as a narrow therapeutic index drugs (Ganiswarna *et al.*, 1995).

Drugs as sitostatica inhibit development of neoplastic cells selectively. In principle, there are a number of different workplace of sitostatica that inhibit mitosis, working on cell metabolism, working on nucleotides also working and getting in on the DNA biosynthesis pathway.

### Galangal

Rhizomes, stems and leaves contain saponins and tannins, in addition rhizomes and stems contain flavonoids, rhizomes also contain essential oils (Depkes, 2006).

#### a. Saponin

It is an alkaloid steroids compounds which can be found that can be found in many plants, has properties such as soap or detergent, water, fat and polar solvents soluble also resistant to heating up to 100°C. Saponin has the effect of anti-fungal, anti-bacterial, anti-inflammatory, lowering blood cholesterol levels and may inhibit the growth of cancer cells (Davidson, 2004; Nworgu, 2007).

Saponin is classified into two: steroidal saponin and triterpenoid saponin. In the field of pharmaceutical steroids/triterpenoids is used for the manufacture of contraceptive, anabolic, and anti-inflammatory, anti-diabetes and skin disorders drugs (Robinson, 1995). When saponin is hydrolyzed, it will produce aglycone called sapogenin. It is a compound that is easily crystallized through acetylation that can be purified

and studied further. Saponin which is potentially harsh or toxic is often called sapotoksin (Gunawan, 2004).

Examples of saponin compounds are: Asparagosides (*Asparagus officinalis*), Avenocosides (*Avena sativa*), Disogenin (*Dioscorea floribunda*) and *Trigonella foenum graceum* (Teguh Hartono, 2009).

#### b. Flavonoid

Flavonoid is chemical compound found in plants, concentrated in the seeds, fruit skins, stems, leaves, roots and flowers. Flavonoids present in all green plants, so it is found in each plant extract (Trilaksini, 2005).

Flavonoid is known as anti-oxidant, beside that this compound has been reported to have an effect as anti-bacterial, anti-viral, anti-allergy, anti-platelet, anti-inflammatory, and anti-cancer (Buhler, 2000).

According Dinata (2006) flavonoid has distinctive natures that are very pungent smell, mostly a yellow pigment, soluble in water and polar solvents, easily decompose at high temperatures (> 100°C).

Chemically, flavonoid has a chain branching phenol groups. According to Katzung (2004), phenolic compound has a corrosive effect, can denature protein, destroy microbial cell walls and membranes also deactivate enzymes. It is bactericidal (including mycobacteria), fungicidal, and able to inactivate the lipophilic viruses.

#### c. Essential oils

Essential oil is a compound that can be found in every part of the plant such as leaves, flowers, fruit, seeds, stems, rhizomes and barks, it is volatile at room temperature, easily oxidized by light, smell fragrant depends on plants producer, does not dissolve in water, but soluble in polar solvents (Kemal, 2001).

Essential oils can evaporate at room temperature and easily oxidized by light. Dry clean dark and covered glass bottles is a good storage place for essential oil (Kurnia, 2006; Hasim, 2003; Kemal, 2001).

#### d. Alkaloid

Alkaloid is a class of organic compound that mostly found in nature. Almost all of the alkaloids derived from plants and are widespread in various types of higher plants. There is more alkaloid in

dicotyledonous plants, where as for monocot plants and pteridofita plants contain lower alkaloid.

Alkaloid is produced by many organisms, ranging from bacteria, fungi (mushrooms), plants, and animals. Rough extraction can easily be done via acid-base extraction techniques. Taste of bitter or bitterness felt by the tongue can be caused by alkaloids.

Alkaloid is often optically active, and there usually has one optical isomer found in nature, although in some cases known racemic mixture, and in other cases the plants containing one isomer while other plants containing enantiomernya (Padmawinata, 1995). There is also a liquid alkaloid, such as konina, nikotina, and higrina. Most alkaloids have a bitter taste.

#### **Cytotoxic Test with MTT Method**

Cytotoxic test is used to predict new cytotoxic drugs from natural products as anti-cancer potential. The basis of this experiment, among others, that the system will provide a determination of the biological activity of dose-response curves and response criteria that indicate a relationship proportional to the number of cells (Anggrianti, 2009). Cytotoxic test is conducted by dissolving the samples in DMSO. DMSO is chosen as the solvent because it has been reported that the use of DMSO had no effect on cell proliferation (Maryati and Sutrisna, 2007).

End of test can provide information of cytotoxic drug concentration that still allows the cells alive (Anggrianti, 2008). Cytotoxic test can use the parameters IC<sub>50</sub> values. IC<sub>50</sub> values indicate the potential of a compound as a cytotoxic agent. The greater the value of the IC<sub>50</sub> the less toxic compounds (Melannisa, 2002).

#### **Extraction, Fractionation and Determination of Group Compounds**

Extraction is the process of dissolving the components in crude drugs selectively with a suitable solvent. In general extraction, solvent is divided into 3 types: non-polar solvent will dissolve non-polar compounds, semi-polar solvents will dissolve the semipolar compound and polar solvents will dissolve polar compounds. In general, the extraction is done successively from non-polar solvents (eg n-hexane, benzene), semi-polar solvent

(eg, chloroform, ethyl acetate, and methylenechloride), then with a polar solvent (eg, methanol and ethanol) (Ritiasa *et al*, 2000 ).

Fractionation is the separation of the components in the extract based on polarity. There are some types of fractionation such as liquid-liquid extraction (ECC) and vacuum liquid chromatography (VLC). Both methods are performed by using solvent mixtures with increasing polarity. The results obtained from the fractionation named fraction (Salni, 2003).

To determine the class of active compounds, it is tested by Thin Layer Chromatography (TLC). The test procedure is as follows, active TLC fractionation at a concentration of 1% spotted on F<sub>254</sub> silica gel plate and then sprayed with a solution of H<sub>2</sub>SO<sub>4</sub> and then placed on a water bath. It can be seen that the active compounds contained in the fractionation results (Salni, 2003).

#### **METHODS**

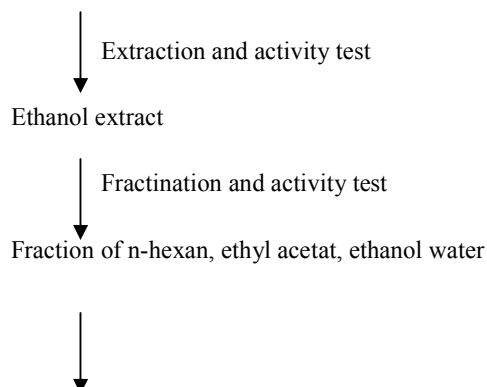
This study was explorative experimental study. The study was conducted on cultured HeLa cells with cytotoxic drugs doxorubicin, ethanol extract, ethyl acetate fraction, the fraction of n-hexane and ethanol fraction of water from galangal (*Alpinia galanga*). Cytotoxic activity assay performed using the MTT method. Determination of the active class of compounds tested by Thin Layer Chromatography (TLC).

This research was conducted at the Laboratory of Postgraduate of Sriwijaya University to perform the extraction and fractionation. And Laboratory of Parasitology Faculty of Medicine, University of Gadjah Mada for cytotoxic test. This study took place in June-August 2012.

Subjects in this study is HeLa cells obtained from the Laboratory of Parasitology, Faculty of Medicine, University of Gadjah Mada and test preparation in the form of ethanol extract, ethyl acetate fraction, the fraction of n-hexane and water fractions of ethanol made in the Laboratory of Sriwijaya University Graduate School.

### Flow Chart

Galangal plant (*Alpinia galanga*)

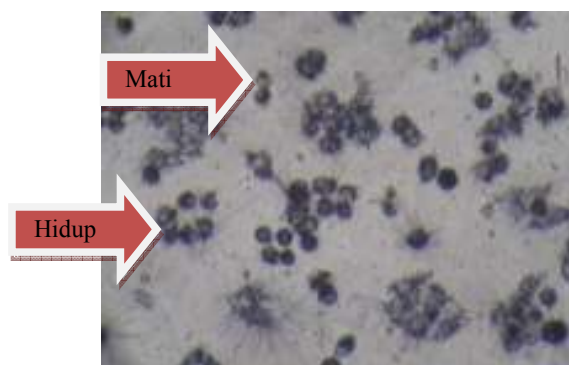


Determination of the class of bioactive compounds  
Determination of IC50 values  
Test equality with doxorubicin

Cytotoxic test using the parameters IC50, IC50 value indicates the concentration that produces 50% cell proliferation barriers and demonstrate the value of the concentration of a compound that has potential as a cytotoxic agent. The greater the IC50 values of these compounds the less toxic. The data presented in tables and graphs.

### RESULTS AND DISCUSSION

HeLa cells were grown in RPMI-1640 serum culture and then treated with the test material in the form of extraction of galangal (*Alpinia galanga*). Living cells have an idea as mutually huddle squamous epithelium and attached to the base pitting on mikroplate. HeLa cells were dead after a given treatment is round and tend to separate.



Picture of Dead and Living HeLa Cells After Galangal Extraction is Given

Average Percentage of Viability and Value of IC 50

Ethanol Extraction Galangal

Content	Percentage Viability			Average % Viability	IC 50
	Nilai I	Nilai II	Nilai III		
200	40.738	42.246	40.989	41.324	92.648
100	46.773	43.504	40.235	43.504	
50	52.557	46.521	59.095	52.724	
25	74.686	79.966	81.727	78.793	
12.5	95.054	94.803	92.54	94.132	

Galanganl extract (*Alpinia galanga*) in this study had IC50 values of 92 648 µg/ml which means it had a higher cytotoxic capability when compared to compound 5-flourourasil (129.394 g/ml), ethanol extract of leaves of *Aglaiia elliptica* Blume with IC50 values of 282.44 µg/ml and had a lower cytotoxic capability when compared with *kalanon* compounds (22.89 mg/ml), the 2,4-dinitrophenylhydrazone compound (61.89 µg/ml), ethanolic rhizome xtract of *Temu Kunci* (*Boesenbergia pandurata*) the IC50 value of 87 µg/ml and hairy roots containing terpenoids Chinese *Arthemisia* active against HeLa cancer cells with IC50 values of 28.12 mg/ml.

To find out the significant differences among the concentrations that had been done, using statistical Kruskal-Wallis test for each percentage viability, obtained probability 0.014 which means that there were significant differences between the concentrations of ginger extract against HeLa cell viability percentage.

Galangal Crude Fractination Result

Solvent	Weight Fraction (gr)	Weight Percent (%)
Ethyl Asetat	12,2	6,1
N Hexan	18,5	9,25
Ethanol Water	28,6	14,3

From the above table, ethyl acetate fraction showed as much as 12.20 grams (6.10%), n-hexane fraction 18.50 grams (9.25%) and ethanol extract 28,60 grams (14.30%) in the form of pasta. These three kinds of fractions obtained were tested to

determine the type of cytotoxic activity of the active fraction.

Average Percentase of Viability and IC 50 Value

Ethyl Acetate Fraction of Galangal

Content	Percentage Viability			Average % Viability	IC 50
	Value I	Value II	Value III		
200	190.863	159.933	192.624	181.140	–
100	200.419	206.706	191.618	199.581	
50	146.102	142.833	140.067	143.001	
25	109.137	132.523	124.225	121.961	
12.5	120.453	124.476	112.909	119.279	

The table above showed the absorbance values of each of the three replication and viability percentage values obtained at a concentration of 200 µg/ml (181.140%), 100 µg/ml (199.581%), 50 µg/ml (143.001%), 25 µg/ml (121.961%) and a concentration of 12.5 mg/ml (119.279%). From these data it appeared that the percentage viability values is above the maximum value of viability (100%), this means that the ethyl acetate fraction of galangal (*Alpinia galanga*) did not have a cytotoxic effect on HeLa cells and the IC50 value was not obtained. Figure 4.4 shows the HeLa cells are still alive and no one died after receiving treatment ethyl acetate fraction galangal (*Alpinia galanga*) with MTT method.

To find out the significant differences between the concentrations that have been done then performed statistical Kruskal-Wallis test for each percentage viability, obtained probability 0.014 which means that there are significant differences between the concentration of ethyl acetate fraction of galangal (*Alpinia galanga*) against the percentage of HeLa cell viability.

Average Percentage Viability and IC 50 Value  
Fraksi N Heksan Lengkuas

Content	Percentage Viability			Percentage % Viability	IC 50
	Value I	Value II	Value III		
200	14.837	15.088	15.842	15.256	13.010
100	14.334	13.328	13.328	13.663	
50	17.100	16.848	16.848	16.932	
25	37.469	36.966	36.211	36.882	
12.5	48.030	53.311	53.06	51.467	

n-Hexane fractionation of galangal (*Alpinia galanga*) from the highest concentration of 200 µg/ml had an average viability of 15.256% and the average percentage of viability will increase proportional to the decrease in the concentration of the test compound such as at a concentration of 100 µg/ml (13.663%), 50 µg/ml (16.932%), 25 µg/ml (36.882%), and a concentration of 12.5 µg/ml had the greatest viability (51.467%).

The cytotoxic ability of n-hexane fractionation of galangal (*Alpinia galanga*) was greater than the ability of sitosoksik from galangal extraction (*Alpinia galanga*), it is apparent from their respective IC50 values ie n-hexane fractionation of galangal (*Alpinia galanga*) of 13.010 µg/ml and galangal extraction (*Alpinia galanga*) amounted to 92.648 µg/ml.

To find out the significant differences between the concentrations that had been done then performed statistical Kruskal-Wallis test for each percentage viability, obtained probability 0.009 which means that there are significant differences between the concentrations of n-hexane fraction of galangal (*Alpinia galanga*) against the percentage of HeLa cell viability.

Percentage Average Viability and IC 50 Value  
Ethanol Water Fraction of Galangal

Content	Absorbansi			Average % Viability	IC 50
	Value I	Value II	Value III		
200	117.184	116.932	120.956	118.357	–
100	117.938	124.979	115.926	119.614	
50	116.429	116.681	113.663	115.591	
25	118.944	118.441	116.681	118.022	
12.5	119.447	116.681	122.464	119.531	

The table above showed the absorbance values of each of the three replication and viability percentage values obtained at a concentration of 200 µg/ml (118.357%), 100 µg/ml (119.614%), 50 µg/ml (115.591%), 25 µg/ml (118.022%) and a concentration of 12.5 mg/ml (119.531%). From these data it appeared that the percentage viability values above the maximum value of viability (100%), it meant that the water ethanol fractionation of galangal (*Alpinia galanga*) did not have a cytotoxic effect on HeLa cells and the IC50 value was not obtained.

To find out the significant differences between the concentrations that have been done then performed a statistical T tests for each viability percentage, probability of 0.391 is obtained which means there was no significant difference between the concentration of ethanol fraction of galangal (*Alpinia galanga*) against the percentage of HeLa cell viability.

From the fractionation results showed that the anti-cancer bioactive compounds galangal (*Alpinia galanga*) was pulled by the solvent n-hexane. This solvent would separate the anti-cancer compounds contained in the extract of galangal (*Alpinia galanga*), so that it would inhibit the growth of HeLa cells in the presence of HeLa cells that died after receiving treatment from galanga fractionation I (*Alpinia galanga*). The active compounds will attack a number of HeLa cells, if the fraction of the chemical components galangal galangal (*Alpinia galanga*) attacked one component of HeLa cells, there will be damage to HeLa cells that will eventually lead to death in HeLa cells. Difference IC50 value of each fraction influenced by the differences in the value of the percentage of viability.

Cytotoxic test results obtained with the MTT method showed fractionation of n-hexane had cytotoxic ability against HeLa cells, followed by a test of Thin Layer Chromatography (TLC) to determine the class of compounds based on the color patches arising on silica gel plates.



Figure shows the test results bioautografi (purple color)

In the picture it appeared that bioautografi test results produce a purple color which indicated that the active compounds containing terpenoids.

Terpenoids is a hydrocarbon group which has a basic formula  $(C_5H_8)_n$ . Terpenoid is produced by plants as secondary metabolites and mainly contained in the sap and cell vacuoles. Examples of steroid compounds are terpenoids, carotenoids, and retinol and compiled many essential oils for example eugenol. Terpenoid compound is isometric hydrocarbons which is also present on the fat/essential oils, which is a kind of fat that is essential for the body. Terpenoids substances help the body in the process of organic synthesis and recovery of body cells and act as an antimicrobial (Yuharmen *et al.*, 2002).

Average Percentage Viability and  
IC 50 Value Doxorubicin

Content	Absorbance			Average % Viability	IC 50
	Value I	Value II	Value III		
50	5.029	19.11 1	20.11 7	14.753	7.627
25	16.09 4	33.19 4	37.72	29.003	
12.5	27.91 3	45.26 4	50.54 5	41.241	
6.25	53.81 4	62.61 5	59.09 5	58.508	
3.125	57.33 4	67.89 6	63.87 3	63.034	

The table above showed the percentage of viability and IC50 values of the comparative drugs (doxorubicin) and it appeared that the average percentage viability of doxorubicin will increase proportionally to the decrease in concentration.

Statistical analysis of test results with T test between the concentration of doxorubicin obtained probability value 0.001 which means that there was significant differences between the concentrations of doxorubicin to HeLa cell viability percentage.

Equality test was conducted by comparing the average value of the percentage viability of the n-hexane extraction and fractionation of galangal (*Alpinia galanga*) with an average value of percentage viability of doxorubicin.

Statistical analysis of test results with T test between the IC50 values of doxorubicin and extraction galangal (*Alpinia galanga*) obtained probability value 0.000 which meant that there was significant differences between the IC50 values of

doxorubicin and extraction of galangal (*Alpinia galanga*). Also with the results of statistical analysis to test T test between the IC50 values of doxorubicin with fractionation galangal (*Alpinia galanga*), which showed similar results with a probability value was 0.025, which means there was a significant difference between the IC50 values of doxorubicin and fractionation galangal (*Alpinia galanga*).

IC 50 Value Extraction dan Fractination of Galangal and Doxorubicin

Material Test	IC 50 Value
Extraction of Galangal ( <i>Alpinia galanga</i> )	92.648
Fractination N Heksan of Galangal ( <i>Alpinia galanga</i> )	13.010
Doxorubicin	7.627

Results of statistical analysis by the *Post Hoc Test* on doxorubicin line and galangal extracts showed the probability of 0.000, which meant there was a real and significant difference between the IC 50 values of doxorubicin and IC 50 values of galangal extract (*Alpinia galanga*). And the line of doxorubicin and galangal fractions showed that the probability of 0.045 meant that there was real and significant difference between the IC 50 values of doxorubicin and the IC 50 values of fractionation galangal (*Alpinia galanga*).

Equality test performed by regression analysis to be derived regression equation to obtain an equivalent concentration values between the extraction of galangal (*Alpinia galanga*) with doxorubicin and fractionation galangal (*Alpinia galanga*) with doxorubicin.

Concentration Equality Value of Extraction and Fractination of Galangal also Doxorubicin

Material test	Consentration
Extraction of galangal ( <i>Alpinia galanga</i> )	8 µg/ml
Fractination N Heksan Of Galangal ( <i>Alpinia galanga</i> )	2,4 µg/ml
Doxorubicin	1 µg/ml

The above table showed that at a concentration of 1 µg/ml concentration of doxorubicin was equivalent to 8 µg/ml extract of galangal (*Alpinia galanga*) and was equivalent to a

concentration of 2.4 µg/ml fractionation of galangal (*Alpinia galanga*).

## CONCLUSION AND SUGGESTION

### Conclusion

Based on the research that has been carried out, it can be concluded:

1. Extraction of galangal (*Alpinia galanga*) has cytotoxic activity against HeLa cells with IC 50 values of 92 648 µg/ml.
2. Fractionation of ethyl acetate and ethanol water from galangal (*Alpinia galanga*) does not have cytotoxic activity, but fractionation of n-hexane galangal (*Alpinia galanga*) has cytotoxic activity against HeLa cells with IC 50 values of 13 010 µg/ml.
3. Fractionation of galangal (*Alpinia galanga*) contains active compounds terpenoids marked with orange spots.
4. Concentration of 1 µg/ml concentration of doxorubicin is equivalent to 8 µg/ml extract of galangal (*Alpinia galanga*) and is equivalent to a concentration of 2.4 µg/ml fractionation of galangal (*Alpinia galanga*).

### Suggestion

1. It is necessary to determine the structure of terpenoid compounds obtained from galangal (*Alpinia galanga*)
2. Further testing should be done on cytotoxic activity of extracts and fractions of galangal (*Alpinia galanga*) obtained in guinea pigs *in vivo* and proceed with clinical testing.
3. Further research is needed to be done to the family Zingiberaceae that will obtain more information about the cytotoxic activity of Zingiberaceae family.

### References

- Ahmad, dkk. 2008. Pengaruh Antioksidan Ekstrak Jahe Merah (*Zingiber officinale* Roscoe var. *sunti*) terhadap proliferasi Sel Leukimia (THP-1). Penulisan Ilmiah. IPB (Bogor Agricultural University). Bogor.
- Alam, G., dan Tayeb, R.. 2003. Fraksinasi dan uji Toksisitas Ekstrak Metanol Bintang Laut

- (*Protoreaster nodusus* W.) Terhadap Larva *Artemia salina* Leach. *Pharmakon*. 4 (2). 48-52.
- Ardiansyah. 2007. Senyawa Antimikroba Tumbuha. Bagian Kedua. [Http://Kompas.com/Kompas-cetak/0409/15/sorotan/1265264.htm](http://Kompas.com/Kompas-cetak/0409/15/sorotan/1265264.htm).
- Aryanti, dkk. (2005). Pemisahan Kromatografi Kolom Akar Berambut *Arthemisia Cina* terhadap sel kanker HeLa.
- Ayu., Pradjatmo. 2004. Prevalensi Kanker Serviks di Indonesia.
- Betina, V.. (1973). Bioautography in paper and thin layer chromatography and its scope in the antibiotic field. *J. Chromatogr.*. (78). 41-51.
- Buhler DR, Miranda C. 2000. Antioxidat Activities of Flavonoids. [Http://Ipi.Oregonstate.edu/f.wOO/flavonoid](http://Ipi.Oregonstate.edu/f.wOO/flavonoid).
- CCRC FARMASI. UGM. Sop Persiapan Kerja Lab. 2011
- Darwis, D. 2000 *Teknik Dasar Laboratorium Dalam Penelitian Senyawa Bahan Alami Hayati*. Workshop Pengembangan Sumber Daya Manusia Dalam Bidang Kimia Organik Bahan Alami Hayati. FMIPA Universitas Andalas Padang.
- Davidson MW. 2004. Saponin. [Http://micro.magnet.fsu.edu/Phytochemicals](http://micro.magnet.fsu.edu/Phytochemicals)
- DeFillippis, R.A., Goodwin, E.C., Wu, L., DiMaio, D.. 2003. Endogenous Human Papillomavirus E6 and E7 Proteins Differentially Regulate Proliferation, Senescence, and Apoptosis in Hela Cervical Carcinoma Cells. *Journal of Virology*. Vol.77. no.2. 1551-1563.
- Depkes RI. 2000. Parameter Standar Umum Ekstrak Tumbuhan Obat. Depkes RI. Direktorat Jendral POM. Direktorat POM.
- Depkes RI. 2001. Peningkatan Kasus Baru Kanker Serviks. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 28 Maret 2012.
- Depkes. 2006. Tanaman Obat. Lengkua Merah. [Http://iptek.apjii.id/artikel/ttg-tanaman-obat-depkes buku 22-017.pdf](http://iptek.apjii.id/artikel/ttg-tanaman-obat-depkes-buku-22-017.pdf).
- Depkes. 2000. *Cara Pembuatan Simplisia*. Depkes RI. Jakarta. 2-22.
- Dey, P.M. and J. B. Harborne. 1991. *Methods in Plant Biochemistry*. Sixth Edition. Academic Press. London.
- Dianada, 2007. Faktor Resiko Kanker Serviks. <http://en.wikipedia.org/wiki/faktorresikokanker-serviks>. diakses tanggal 01 April 2012.
- Ekowati, H. 2008. Uji Sitotoksik dan Uji Apoptosis Senyawa Kalanon. FK UGM.
- Farnworth, N.R. (1996). *Biological and Phytochemical*.
- Freshney, R.I.. 1986. *Animal Cell Culture. A Practical Approach*. 1st Ed. IRL Press. Washington D.C.
- Goodwin, E.C., DiMaio, D.. 2000. Repression of human papillomavirus oncogenes in Hela cervical carcinoma cells causes the orderly reactivation of dormant tumor suppressor pathways. *Biochemistry*. Vol.97. no.23.
- Gewirtz. 1999. Obat Sitostatika.
- Hanahan, D., and Weinberg, R. A.. 2000. The Hallmarks of Cancer. *Cell*. 100. 57-70
- Handoko, dkk. (2011). Aktivitas Sitotoksik Ekstrak Etanolik Rimpang Temu Kunci (*Boesenbergia Pandurata*) Terhadap Sel Kanker Serviks HeLa dan sel Kolon WiDr.
- Harmanto, N. 2003. Sehat dengan ramuan Tradisional Mahkotadewa. Cetakan Pertama. Tangerang. PT. Agromedia Pustaka. 31-35.
- Parwata, Oka Ady., Dewi, P. Fanny Sastra. 2008. Isolasi dan Uji Aktivitas Antibakteri Minyak Atsiri dari Rimpang Lengkuas (*Alpinia galanga* L)
- King, R. J. B.. 2000. *Cancer Biology*. Second Edition. Person Education Limited. London.
- Kumar, Abbas, Fausto. 2005. *Pathologic Basis of Disease* 7th ed.
- Labwork Study Guide and Lecture Notes. 2000. Henrietta Lacks. [www.micro.msb.le.ac.uk/Labwork/Lack1.htm](http://www.micro.msb.le.ac.uk/Labwork/Lack1.htm).
- Mangan. 2003. Kanker Serviks pada Wanita Produktif. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 28 Maret 2012.
- Munoz. 2003. Penyebab Kanker Serviks.
- Notodiharjo. 2002. Definisi Kanker Serviks. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 30 Maret 2012.
- Rachmadahniar. 2005. Kanker Serviks di Negara Berkembang. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 30 Maret 2012.
- Rahayu. 1999. Komponen Bioaktif Lengkuas. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 28 Maret 2012.
- Rasidji. 2007. Angka Kejadian Kanker Serviks di Indonesia. <http://en.wikipedia.org/wiki/kankerserviks>. diakses tanggal 30 Maret 2012.
- Ritiasa, K & Muhibat. R. 2000. Parameter Standar Umum Ekstrak Tumbuhan Obat. Departemen Kesehatan RI. Direktorat Jenderal Pengawasan Obat dan Makanan. Jakarta.

## TOXIC EFFECTS OF FORMALDEHYDE KIDNEY Mice (*Mus musculus* L) SWISS WEBSTER MALE

Ra. Hoetary Tirta Amallia, Sri Nita, Theodorus

Program Studi D III Kesehatan Lingkungan, STIKES Muhammadiyah Palembang, Indonesia

Email :Taryardiansyah@yahoo.co.id

### Abstract

*The use of formaldehyde as a preservative was increasing due to higher food production. Effects of formaldehyde cause damage to the kidneys because it was toxic and carcinogenic compounds. The purpose of this study was to assess the effects of formaldehyde on renal which included changes in body weight, changes of weight, morphology and histopathology structure in the kidney. Experiment study was conducted at the Palembang Great Hall of Health Laboratory (so called BBLK) and making histopathology slides and observations performed at the Laboratory of Pathology Charity Hospital RK Palembang (so called RS RK Charitas Palembang) on April until June 2012. There were 32 mice's (*Mus musculus* L) Swiss Webster males are used as animal test that fulfilled criteria and divided into 4 group where acclimatized for one week before being used in the study. The research method used Complete Randomized Design (CRD) with four treatment groups, each group performed 8 repetitions. Group I was as a control group with distilled water administration; groups II, III, and IV were treated with a solution of formaldehyde that is with a dose of 200 ppm, 300 ppm and 400 ppm for 14 days of oral treatment. Then on day 15, the neck was dislocated, and then dissected the abdominal cavity, kidney organs were observed. Observational data was tested by ANOVA followed by post hoc test, to know the differences between treatment groups. The study shown that there were significant differences into change in body weight of mice ( $p = 0.000$ ), the differences of kidney weight meaning found between the control and treatment groups, and histopathology changes in kidney mice significant necrosis of the tubules ( $p = 0.000$ ). Morphology of mice's organs were analyzed descriptively and found significant differences between the control where the colour of change was already seen at a dose of 200 ppm of 62,5%, the colour and consistency changed at doses of 300 ppm of 75% , and change the colour, consistency, and shape appear on the dose of 400 ppm of 62,5%. The conclusion of this study was no effect of oral administration of formaldehyde to the kidneys.*

**Keywords:** *toxic, formaldehyde, kidney, experimental study, mice (*Mus musculus* L)*

### BACKGROUND

Formaldehyde is commonly used as an industrial raw material glue. High concentrations in the body can cause a chemical reaction with almost all substances in the cell, thereby suppressing cell function and cause organ damage. Damage occurs in the cell due to formaldehyde can coagulation proteins contained in the protoplasm and nucleus.

According to the International Programme on Chemical Safety, the threshold of formaldehyde in the body is 1 mg / L. The effect of formaldehyde orally at a dose of 100 mg / kg body weight for 2 months through drinking water on experimental animals showed impaired weight gain, decreased urine production and depletion of the front of the hull (Saraswati, 2009).

The results of this study are expected to contribute to the development of science, especially as information or a referral for further research and most importantly, provide information on the dangers of formaldehyde levels when exposed to humans or ingested as a result of the use of formaldehyde that does not comply with rules such as the addition of formaldehyde as a food preservative.

Lethal dose of formaldehyde administered orally to rats is an animal experiment is 600-800 mg / kg body weight (k Tsuchiya et al., 1975; Smyt et al., 1941 in the OECD, SIDS).

Formaldehyde, if eaten in the short term, it will not cause poisoning, but if buried above the threshold may interfere with health. Dangers of formaldehyde in the short term is if swallowed then the mouth, throat, and stomach will feel burning, pain when swallowing, nausea, vomiting, and diarrhea, the possibility of bleeding, pain great stomach, headache, hypotension, seizures, unconsciousness and coma. While for a long period can cause damage to the liver, spleen, pancreas, kidneys and central nervous system (Ayudiah, et al, 2007).



Kidney is a vital organ that plays an important role in maintaining the stability of the environment in the body. (Sylvia and Lorraine, 2005).

On the condition of damaged kidney or renal failure will occur uremic toxicity, metabolic acidosis, potassium retention, an imbalance of sodium, phosphate and calcium imbalance, loss of plasma proteins, the inability to change the concentration of the urine, hypertension, anemia, and immune system suppression. All of this is very harmful to our body condition (Lauralee, 2011).

The purpose of this study was to determine the toxic effects of formaldehyde administered orally to renal mice (*Mus musculus* L) Swiss Webster males.

HO group (Control): 8 tails  
Group H400 : 8 tails  
Group H600 : 8 tails  
Group H800 : 8 tails  
Total : 32 head

## RESEARCH METHODS

This study uses a pure experiment, with the approach of the post-test only control group design is measuring the effect of treatment (intervention) in the experimental group by comparing formaldehyde 4 intervention groups at a dose of 200 ppm, 300 ppm, 400 ppm (Group H200, H300 and H400) with a control group with distilled water (HO). Animal testing is studied mice (*Mus musculus* L) Swiss Webster males.

The experiment was conducted at the Center for Health Laboratory (BBLK) Palembang, Anatomical Pathology Laboratory RK Caritas Palembang, Palembang RSMH Pathology and Laboratory from April to June 2012.

Here is a sample study of healthy mice, aged between 12-14 weeks with 30-33 grams weight, male sex, able-bodied (no defects), has not been used as experimental animals, are fed, the environment, and the same treatment that obtained from the Animal House ITB.

Sample size was determined based on the sample size approach for ANOVA with the help of special software PS sample size (power sample). In this study, the 4 treatment groups with the formula federe  $(t-1) (n-1) > 15$ . Based on the above calculation, the number of mice used in each treatment group as much as 6 tails, so the total number of samples is 24 test animals mice (*Mus musculus* L) Swiss Webster males. But to achieve results that are more accurate then the sample plus 2 mice, making the total sample of 8 mice from each group of samples.

Sampling and grouping randomized sample, which were divided into 4 groups based on the time of data collection, namely:

## Making preparations and Observations Histopathology.

Kidneys were cleaned in a solution of 0.9% NaCl were fixed in Bouin solution for 3 days. After the kidney was dehydrated with ethanol at a concentration of 70%, 80%, 90%, 100%, respectively, t done  $\rightarrow$  sequence. Then performed infiltration and planting into the kidney cortex paraffin sections, slashed with a rotary microtome with a thickness of 5  $\mu$ m, pads affixed to glass objects that have been given albumen meyer. Incision with hematoxylin & eosin stained ( IAPI, 2008 ).

## Provision of formalin solution.

Formalin is used in this study was formalin with 37% pure concentration with BM 30.03 and 1.08 to 1.09 Bj Merck, in the form of a solution.

## Determination of the dose.

The basis used in calculating doses and Bj is the atomic weight of formalin so on get 37% formalin concentration of 11,999 ppm 1000 ppm stock was then made up to 100 ml. Diluted as needed back to a dose of 200 ppm, 300 ppm, and 400 ppm by using the dilution formula  $C1.V1 = C2.V2$

## Treatment of samples .

Before the experiment, the test animals do acclimatization for 1 week in order to adapt to the experimental environment . After acclimatization for 1 week, determined that healthy mice , then weighed, then a solution of formalin solution was injected orally using a 1 ml injection , at a dose of 0.1 ml/10 g bb with respective predetermined concentration earlier. In the group H0 (control group) were injected intraperitoneally sterile distilled water. Then each mouse was placed in the stable, each and all study mice were given the same food and the environment . After 14 days mice were given treatment on day 15. H0, H200, H300, and H400 examination by means kidneys are organs of mice anesthetized with ether , and then placed on top of the wax bath with supine position , then with the aid of a scalpel and scissors abdominal area until the chest is opened , after it was taken to the stored kidney in formaldehyde for the observed morphologic and histologic preparations made.

### Research parameters.

The parameters examined included changes in body weight of mice, mice kidney weight, renal morphology mice that color / style, consistency, size and shape of the kidneys of mice kidneys of mice, then the mice kidney histopathology observations.

### Observation and calculation data.

Histopathologic examination was performed in the Laboratory of Pathology of Charity Hospital RK Palembang. The Data collected in this study that changes in body weight of mice, mice kidney weight, renal morphology mice include color / style, consistency, Renal histopathological observations kidney of mice. On the kidney histopathology seen is Whether the condition of tubular necrosis or not and what percentage are affected. In the kidneys taken cuts are part of the nephron (the cortex). Readings under a microscope with magnification of 100x and read as many as 10 field of view. The results of the second reading of the same kidney of mice averaged to Obtain the number of cells that undergo tubular necrosis in each mouse.

### Research Variables

1. Variabel dependent
  - Formalin with konsentari 200 ppm, 300 ppm, 400 ppm..
2. Variabel Independent
  - Presence or absence of formaldehyde toxicity effects of oral changes in body weight of mice.
  - Presence or absence of formaldehyde toxicity orally kidney weight changes of mice
  - Whether or not the effect of orally administered formaldehyde toxicity against murine renal morphological changes.
  - Presence or absence of oral toxicity of formaldehyde to changes in renal histopathology.

### Statistic Analysis

1. Descriptive analysis using descriptive of all sizes are needed.
2. Inferential analysis using analysis of variance (ANOVA).

## RESULTS

### a. Formaldehyde Toxic Effects Giving Oral Mice Against Weight Loss Before and After Treatment

No	Formal dehid Dose (ppm)	Rate Before Treatment (gr)	Rate After Treatment (gr)	differe nce (gr)	%	p	F
1	0	31,32	32,393	1,074	3,4	0	949,939
2	200	30,88	29,965	- 0,915	2,9		
3	300	30,87	29,871	- 1,000	3,2		
4	400	35,53	34,114	- 1,411	3,9		

### b. Formaldehyde Toxic Effects Giving Oral Against Kidney Weight in Mice

Dose (ppm)	Rate Kidney Weight Before Treatment (gr)	Rate Kidney Weight After Treatment (gr)	Differen ce (gr)	%	p	F
0	0,564	0,564	0	0	0,002	6,697
200	0,564	0,433	-0,131	23,22		
300	0,564	0,419	-0,145	25,7		
400	0,564	0,676	0,112	19,85		

### c. Formaldehyde Toxic Effects Giving Oral-Mice Against Kidney Morphology

Dose Formal dehid (ppm)	Numbe r of Sample s	Degrees of Renal Morphology Changes							
		0	%	+	%	++	%	+++	%
0	8	8	100	-	-	-	-	-	-
200	8	3	37,5	5	62,5	-	-	-	-
300	8	-	-	2	25	6	75	-	-
400	8	-	-	-	-	3	37,5	5	62,5

Notes:

0 = not found changes  
 + = Found 1 criteria (color change)  
 + + = Found 2 criteria (changes in color and consistency)  
 + + + = Found 3 criteria (changes in color, consistency, and shape)

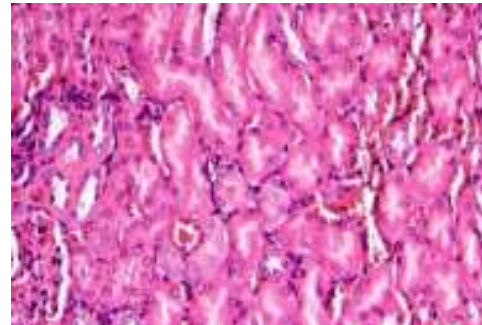
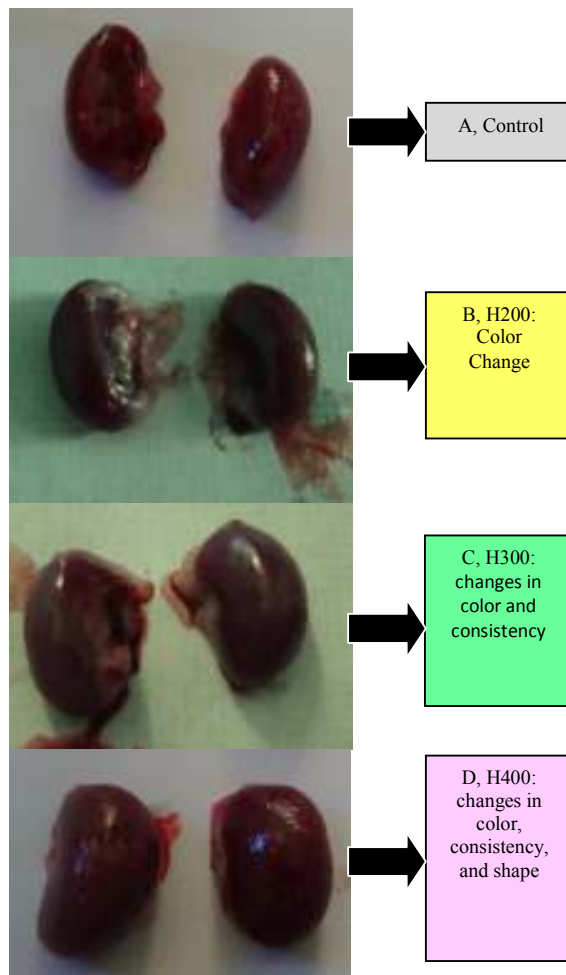


Figure 2. Histopathology Kidney Mice In Group H200 With 400x magnification.  
(Cells Necrosis: Cell Membrane Rupture, the nucleus began to lysis, the cell contents come out)

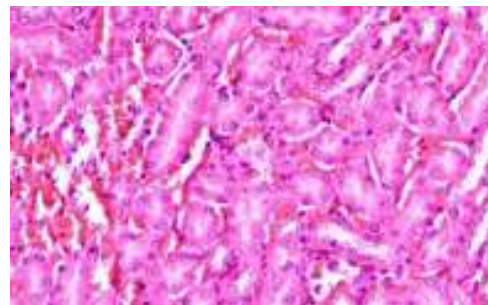


Figure 3. Histopatologi Ginjal Mencit Pada Kelompok H300 With 400x magnification.  
(Cells Necrosis: Cell Membrane Repture, the nucleus began to lysis, the cell contents come out, cell abnormally)

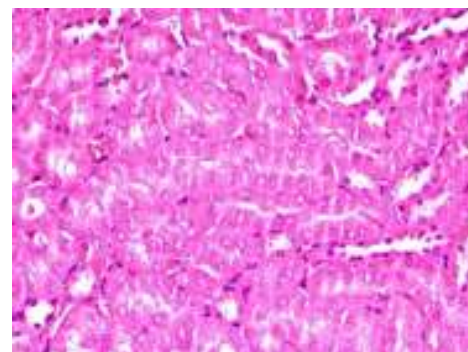


Figure 4. Histopathology Kidney Mice In Group H300 With 400x Magnification  
(Cells Necrosis: Cell Membrane Repture, Nuclei Lysis, Cells Fill Out Form Cells So It Starts Normal Form)

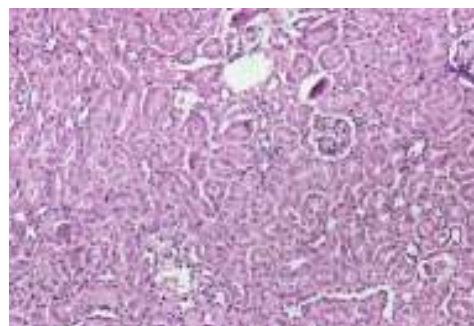


Figure 1. Histopathology Kidney Mice In Control Group With 400x magnification.  
(RC: Renal Corpuscles; PCT: Proksimal convoluted Tubule; DCT: Distal Convoluted Tubule)

d. Provision of Toxic Effects Of Formaldehyde In Oral Histopathology Kidney Structure

From the picture above can be distinguished form of necrosis between the control group to the treatment group who experienced necrosis. In control cells looked normal tubules were still Diman core is still unclear, cell boundaries are still firm, and the cytoplasm is still unclear. However, at doses of 200 ppm and 300 ppm, in the nucleus of cells undergoing necrosis and cell boundaries are blurred and the cytoplasm of the cell with other cells has been mixed. Conditions are even worse looks at a dose of 400 ppm in which the cells are

no longer evident between the original core, the boundary of the cell, and the cytoplasm because everything is broken and mixed. To get the number of tubules and the number of cells that undergo tubular necrosis, tubular cell count of the number of cells in both kidneys of each of the individual mice and the average taken were read in the 10 field of view with a magnification of 100 times. Here are the results pembacaan of renal histopathology preparations:

The reading results Perparat Histopathology Kidney.

NO	RATE TUBULUS CELL AND RETE NECROSIS CELL NEKROSIS BY GROUP OF TREATMENT											
	CONTROL			200 ppm			300 ppm			400 ppm		
	Total of Tubulus	Total Tubulus Necrosis	%	Total of Tubulus	Total Tubulus Necrosis	%	Total of Tubulus	Total Tubulus Necrosis	%	Total of Tubulus	Total Tubulus Necrosis	%
1	1100	0	0	1102	77	7%	1090	109	10%	1100	198	18%
2	1186	0	0	1200	108	9%	1150	126	11%	1200	216	18%
3	1125	0	0	1100	77	7%	1200	156	13%	1150	230	20%
4	1150	0	0	1170	94	8%	1100	110	10%	1185	213	18%
5	1200	0	0	1100	110	10%	1180	141	12%	1150	230	20%
6	1200	0	0	1150	80	7%	1200	156	13%	1180	259	22%
7	1105	0	0	1200	72	6%	1100	110	10%	1200	240	20%
8	1200	0	0	1150	92	8%	1150	103	9%	1100	242	22%
avg	1158	0	0	1146	89	8%	1146	126	11%	1158	228	20%

## CONCLUSIONS

1. Giving oral solution of formaldehyde has toxic effects on the kidneys of mice.
2. Weight loss was significant ( $p = 0.00$ ) in mice given orally at a dose of formaldehyde 200 ppm, 300 ppm, and 400 ppm.
3. The big difference in the kidney weight of mice was significant ( $p = 0.002$ ) after oral administration of formaldehyde at a dose of 200 ppm, 300 ppm, and 400 ppm, and no effect of formaldehyde.
4. Morphological damage to the kidneys of mice started at a dose of 200 ppm in the form of discoloration, at a dose of 300 ppm color and consistency changes, at a dose of 400 ppm morphological damage occurs in all degrees of damage in the form of changes in color, consistency, and form in the kidneys.
5. Renal histopathological abnormalities of mice was significant ( $p = 0.000$ ) in the form of necrosis of proximal tubular cells and distal

formaldehyde after oral administration at doses of 200 ppm, 300 ppm, or 400 ppm.

## References

- Ahmad Aulia Jusuf, 2001, *Histologi Sistem Perkemihan*, Universitas Indonesia
- Ayudiah A., Amar Ma'ruf., Zaqia N., Dian P. 2007. *Studi Kasus Penggunaan Formalin pada Tahu Takwa di Kotamadya Kediri*. UMM. Malang.
- Budavari, S., Windholz, M., Stroumstos, L. Y., 1989, *The Merck Index: An Encyclopedia of Chemicals and Drugs*, Merck & Co., New Jersey, pp 346, 774.
- Cahyadi, W. 2006. *Analisis dan Aspek Kesehatan Bahan Tambahan Pangan*. Bumi Aksara. Jakarta.
- Campbell, Neil A, 2004, *Biologi*, Erlangga, Jakarta
- Chanif Mahdi., Aulaniam., Widodo M.A., Sumarno. 2007. *Jurnal Protein*. Yogurt sebagai Detoksikan yang Efektif Terhadap

- Formalin yang Terpapar dalam Makanan. Universitas Sriwijaya. Palembang.
- Donatus, I. A. 2001. *Toksikologi Dasar*. Laboratorium Farmakologi dan Toksikologi. UGM Yogyakarta.
- Frank C Lu. 1995. *Toksikologi Dasar*. Universitas Indonesia. Jakarta.
- Hartati Kartikaningsih. *Kajian Kerusakan Ginjal Mencit Akibat Paparan Ikan Nila (Oreochromis niloticus) Berformalin*
- Underwood. J.C.E. 1999. *Patologi Umum dan Sistemik*. EGC. Jakarta.
- Jones, L.M., H. B. Nicholson, Leslie, E.M., Donald. (1997). *Veterinary Pharmacology and Therapeutics*. 4th. Oxford and IBH Publishing Co. New Delhi, Calcuta, Bombay.
- Ketut Suwitra. *Gagal Ginjal Kronik*. Jilid 1. 2001. Universitas Indonesia. Jakarta
- Khomsan A., Anwar F., Riyadi H., Sukandar D., & Mudjajanto ES. 2007. *Studi Implementasi Program Gizi: Pemanfaatan, Cakupan, Keefektifan, dan Dampak terhadap Status Gizi*. Bogor: Institut Pertanian Bogor.
- Laith A. Jawad. 2003. *The Effect of Formalin, Alcohol, and Freezing on some body Proportions of Alepes Djeddaba (Pisces: Carangidae) collected from The Red Sea coast of Yemen*. New Zealand
- Lauralee Sherwood. 2011. *Fisiologi Manusia*. Edisi 6. EGC. Jakarta
- Lund, W., 1994, *The Farmaceutical Codex*, 12 th, 598, The Farmaceutical Press, London
- Luis C.J., Jose Carneiro., Alih Bahasa. Adji Dharma. 1980. *Histologi Dasar*. Edisi 3. CV. EGC. Jakarta.
- Nephron Information Center. *Nefron dan Pembuluh Darah*.  
<http://www.Sectioncadaveris.wordpress.com>, diakses 03 Maret 2012).
- Perhimpunan Dokter Spesialis Patologi Indonesia. 2008. *Pedoman Penanganan Bahan Pemeriksaan untuk Histopatologi*. Jakarta.
- Peraturan Menteri Kesehatan Republik Indonesia Nomor: 722/MENKES/PER/IX/88. *Bahan Tambahan Makanan*.
- Redi Yuniarto. 2007. Artikel diskripsi. *Pengaruh Paparan Berulang Ikan Nila (Oreochromis niloticus) Berformalin secara Oral selama satu Bulan terhadap Perubahan Fisiologi Mencit (Mus Musculus)*. Universitas Brawijaya. Malang.
- Robert Meadows, M.D., F.R.C.P.A. 1973. *Renal Histopathology. A Light Microscopy Study of Renal Disease*. Oxford University Press. New York Melbourne. London.
- Sipes, I. G dan Gansdolfi, A.J. 1986. Biotransformation of Toxicant. Di dalam: Donatus, I. A. *Toksikologi Dasar*. Laboratorium Farmakologi dan Toksikologi. UGM Yogyakarta.
- Skorecki K, Green J, Brenner BM. 2005. *Harrison's principles of internal medicine 16th ed*. USA: McGraw-Hill.
- Sri Hastuti. 2010. *Analisis Kualitatif Formaldehid pada Ikan Asin di Madura*. Universitas Trunojoyo.
- Syaifuddin. 2011. *Anatomi Tubuh Manusia*. Salemba Medika. Jakarta.
- Sylvia A. Price. Lorraine M.Wilson. 2005. *Patofisiologi*. EGC. Jakarta
- The United States Pharmacopeial Convention. 1985. *Pharmacopeia*. The United States. Washington.
- The Merck Index. 1989. *An Encyclopedia of Chemicals, Drugs and Biologicals*. USA.
- Tyas Rini Saraswati., Endah Indraswari., Nurani. 2009. *Pengaruh Formalin, Diazepam dan Minuman Beralkohol terhadap Konsumsi Pakan, Minum dan Bobot Tubuh Mus Musculus*. Lab. Biologi Struktur dan Hewan. Universitas Diponegoro. Yogyakarta.
- T.Y., Ismail, S., Entum, S.H., Silitonga, L.R.M Sabirin, B.M Zainal, K., dkk., (1989). *Teknik Pengelolaan Sediaan Histopatologi dan Sitologi*. Laboratorium/Instansi Patologi Anatomi Universitas Padjadjaran Rumah Sakit DR. Hasan Sadikin. Bandung.
- UNSW Embryology. *Development of the Kidney – Nephron*.  
(<http://embryology.med.unsw.edu.au/notes/urogen7.htm>, diakses 23 Juli 2012)
- Usu Digital Library. 2004. *Resiko Pemajanan Formaldehid sebagai Bahan Pengawet Tekstil di Lingkungan Kerja*. Medan.

## FARMERS BEHAVIOR TOWARD RISKS OF POTATO FARMING FOR GRANOLA AND ATLANTIC VARIETIES IN BANJARNEGARA REGENCY

Pujiharto

Agricultural Faculty University of Muhammadiyah Purwokerto

### **Abstract**

*The research aims to determine farmers behavior toward risks of potato farming of Granola and Atlantic varieties and factors influencing farmers behavior towards risk. This research was conducted in the three districts of Banjarnegara Regency, those are Batur, Pejawaran and Wanayasa. From a sampling frame of 270 farmers, it was taken 151 farmers as sample by applying purposive sampling method. statistical t-test, test of variance and ordinary least square. (OLS) were applied in analysis.*

*The result of the research showed that, most farmers in these area are risk averter who were mostly planting Atlantic variety and the risk loving or neutral farmers chose to plant Granola variety. The factors to induce their risk aversion are the level of pest disease attack and productivity risk. Meanwhile farm size, farmer education and off-farm income influence the preference of farmers toward risk.*

**Keywords:** risks, potato, farmers behavior toward risks

### **A. BACKGROUND**

Potato (*Solanum tuberosum*) is one of the horticulture products which enriched with high nutrition as alternative food after the rice and corn needed by people for foodstuff. There are some benefits of potatoes, i.e., (1) an alternative for food diversification with high value of nutrition; (2) a crop which give an income for the farmers; (3) a non-fuel commodity export; (4) raw materials for food industry and fast food (Foragri, 2009).

After 1980s, new varieties of potatoes had been introduced in Indonesia, such as: (1) **Granola**, with productivity reaches 25 tons/hectare; counted for 18 tons of high quality, 4 tons of medium quality, 2 tons of mixed quality, and a ton of low quality. Its crop harvest was normally about 90 days; (2) **Atlantic**, has two types as long and round shapes. The solidness of its tuber is 22-34% (while Granola is 18%), low sugar content, white flesh tuber and it will turn yellow by frying, its tuber can reach 8 cm long and 4 cm wide,

and its diameter is 6 cm with a shallow sapling. Its crop harvesting periode is 90 days (Worldplant, 2010).

Banjarnegara is one of the regencies at the southwest of Central Java Province. It is center for the potatoes production of Granola and Atlantic variety. The Granola has been planting by farmers in this area since 1985, while the Atlantic was introduced in this area in 2006. There are three centers of potato production in this regent as in districts of Batur, Pejawaran, and Wanayasa (BPS Kabupaten Banjarnegara, 2009).

### **B. RESEARCH OBJECTIVES**

Determine farmers' behavior toward risk of potato farming of Granola and Atlantic varieties and their determinant factors of the farmers' behavior toward risk.

### **C. LITERATURE REVIEW**

#### **1. Farm Risks**

Every farm activity is posed with risks and uncertainties which farmers can hardly control. The climate problems like a long drought, uncertain climate, unpredicted pest disease attacks, and natural disaster are aspects of the risk and uncertainties (Soekartawi, 2002). Hardaker *et al.* (1997); Debertin (1986); Cassavant and Infanger (1984) argued that the risk is an imperfect knowledge in which the probability result is impossible to find out, and uncertainty occurs as the probability is not known well.

To quantify the risks, there are three kinds of perspectives on risks (Roumasset, 1979) that are:

- a. Risk as one of the measures on the probable results dispersion, for example as a variant;
- b. Risk as a probability which results in a certain decision; and
- c. Risk of how much an individual should pay to avoid the risk he or she does not prefer.

#### **2. Farmers's Behavior**

The farmers' behavior toward risk of farm, according to Salvatore (1993); Hardaker *et al.* (1997), can be divided into three types, i.e.: refusing the risk (*risk averter*), neutral behave to

the risk (*risk neutral*), and prefer to the risk (*risk lover*).

#### D. THEORETICAL FRAMEWORK

##### The Behavior of Farmers to the Risks

de Janvry (1972) stated that the relation between the input (vector  $X$  vector) and result ( $Y$ ) which is explained in the *generalized power production function* as follows:

$$Y = A \prod_{i=1}^I X_i^{f_i(X)} e^{g(X)} \quad (1)$$

In which  $f_i(X)$  and  $g(X)$  are polynomials of an extent describing a dimension  $K$  of the input of  $X$  vector. For the production function of Cobb Douglas, then  $g(X) = 0$  and  $f_i(X) = \alpha_i$  for  $i$ .

Based on the equation (1), the profit equation will be found out by regarding all production cost is based on the cost variable (Yotopoulos and Nugent, 1976), and it can be formulated into:

$$\pi = P_y \cdot Y - \sum_{i=1}^n P_{xi} X_i \quad (2)$$

In a case of physical relation between the production factors and production, the production function of Cobb Douglas is used, and described as follows:

$$Y = A X_i^{\alpha_i + \beta_i X_i} e^{\gamma_i X_i} \quad (3)$$

It requires that  $\beta_i = \gamma_i = 0$  and the elasticity of production for the variable  $\alpha_i$ , if  $\gamma_i = 0$ . Thus, the profit equation will be:

$$\pi = P_y \cdot (A X_i^{\alpha_i}) - \sum_{i=1}^n P_{xi} X_i \quad (4)$$

Based on an assumption of perfectly competitive market, either the market for production factors or the market of production, meaning that the cost of the production factors and the production for each farmer is constant, to maximize the profit, the equation (4) is derived in condition of  $d\pi/dX = 0$ . Thus, on the first order, to maximize the option of input use (Moscardi and de Janvry: 1977) is:

$$P_y f_i \frac{E(Y)}{X_i} = \frac{P_{xi}}{1 - \theta K(S)} \quad (5)$$

Note:

$E(Y)$  = expected production ( $\mu_y$  = average production)

$\theta$  = Variant coefficient of production ( $\theta = \delta_y/\mu_y$ ) where  $\delta_y$  = deviation standard of production and  $\mu_y$  = average production

$P_y$  = Price of the product

$f_i$  = production elasticity of input of  $-i$  (elasticity of the most significant and has biggest contribution)

$X_i$  = Number of input  $-i$  (the most significant input and contributes most to each

respondent)

$P_{xi}$  = The price of input  $-i$  (the most significant input and contributes most to each respondent)

$K(S)$  = The parameter measurement of reluctance to the risk,  $S$  is a variable representing the farmers' characteristics.

Assuming that the model is right in depicting the process of decision making on farmers, farmers' reluctance to risks, the parameter of  $K(S)$  can be calculated from the production level and the input observed in the equation (6) as follows:

$$K(S) = \frac{1}{\theta} \left( 1 - \frac{P_{xi} X_i}{P_y f_i \mu_y} \right) \quad (6)$$

Equation (6) provides a gauge to calculate the risks  $K(S)$  which is then derived for each farmer in the production function, coefficient of production variation, production and cost factors, and the level of the input use in question (Olarinde *et al.*, 2007).

Furthermore, Moscardi and de Janvry (1977) formulates the parameter of risks rejection  $K(S)$  which is used to classify the farmers into three groups, i.e.:

- Taking the risks (*risk lover*) – low risks ( $0 < K(S) < 0.4$ )
- Taking a neutral position (*risk neutral*) – medium risks ( $0.4 \leq K(S) \leq 1.2$ )
- Rejecting the risks (*risk averter*) – high risks ( $1.2 < K(S) < 2.0$ )

#### E. HIPOTHESIS

It is hypothesized that the farmers tend to avoid the risk (*risk averter*). The factors influencing negative effect to the behavior or the parameter of  $K(S)$  are farm size, the farmers' age, their education, their farm experience, number of their family's dependants, income of potato farm, other incomes, potato variety (Granola), the seed origin (certified), the farm pattern (independence), and terracing technology (permanent). Meanwhile, the level of pest disease attack, the sloping level of the land, the productivity risk, and the income risk positively impose their behavior to the risk.

#### F. RESEARCH METHOD

The basic method applied in this research is a descriptive analysis method. The location of the research was purposively chosen in the region of Banjarnegara regency, since the regency is one of the production centers of potatoes of Granola and Atlantic varieties in Central Java. Then three districts were selected purposively, i.e. Batur,

Pejawaran and Wanayasa as the production center of the potatoes.

Among the farmers in the districts, the sampling frame is used to screen the relevant samples, by selecting the farmers who cultivate the two varieties of potatoes in the recent year (three cropping seasons). This gave 110 farmers (Batur), 68 (Pejawaran) and 92 farmers (Wanayasa). Among the 270 farmers selected based on the sampling frame, they were then refined using the Slovin formula in Consuelo (1993). It resulted in 151 farmers. Each district was sampled proportionally, by taking 60% of the whole population. The data types collected in the study are primary and secondary data. The data were collected through observation, and interview using questionnaire.

To answer the hypothesis that the farmers tend to avoid the risk. To test the hypothesis, it is used the model approach of production function of Cobb Douglas which is analyzed with OLS. It is then obtained the most significant and most contributing production factors (*standardized coefficient beta*), the formula used is the input as stated by Moscardi and de Janvry (1977) and Olarinde *et al* (2007), that is:

$$K(S) = \frac{1}{\theta} \left( 1 - \frac{P_{xi} X_i}{P_{yfi} \mu_{iy}} \right) \quad (7)$$

The parameter of risk refusal  $K(S)$  is used to classify the farmers into three groups, those are: (1) *risk lover*- low risks ( $0 < K(S) < 0.4$ ); (2) *risk neutral*-medium risk ( $0.4 \leq K(S) \leq 1.2$ ); *risk averter*-high risks ( $1.2 < K(S) < 2.0$ )

Meanwhile the hypothesis saying that the factors influencing effect to the farmers' behavior include cropping area, the farmers' age, their education, their farm experience, number of their family's dependants, income of potato farm, other incomes, Granola variety, certified seed, the farm pattern (independence), terracing technology (permanent), the pest disease attack, the sloping level of the land, the productivity risk, and the income risk. To test it, it is used a regression analysis model below:

$$K(S) = \alpha_0 L_{TANAM}^{\alpha_1} U_{PETANI}^{\alpha_2} P_{ENDK}^{\alpha_3} P_{USTAN}^{\alpha_4} J_{MLTGKLG}^{\alpha_5} P_{ENDUSTAN}^{\alpha_6} P_{ENDLUSTAN}^{\alpha_7} SRNG\_HPT^{\alpha_8} KMR\_LHN^{\alpha_9} RISPROD^{\alpha_{10}} RISPEND^{\alpha_{11}} D\_VAR^{\alpha_{12}} D\_ASBNH^{\alpha_{13}} D\_POLUT^{\alpha_{14}} D\_TTERAS^{\alpha_{15}} \quad (8)$$

In ln, it can be formulated as follows:

$$\ln K(S) = \ln \alpha_0 + \alpha_1 \ln L_{TANAM} + \alpha_2 \ln U_{PETANI} + \alpha_3 \ln P_{ENDK} + \alpha_4 \ln P_{USTAN} + \alpha_5 \ln J_{MLTGKLG} +$$

$$\alpha_6 \ln P_{ENDUSTAN} + \alpha_7 \ln P_{ENDLUSTAN} + \alpha_8 \ln SRNG\_HPT + \alpha_9 \ln KMR\_LHN + \alpha_{10} \ln RISPROD + \alpha_{11} \ln RISPEND + \alpha_{12} \ln D\_VAR + \alpha_{13} \ln D\_ASBNH + \alpha_{14} \ln D\_POLUT + \alpha_{15} \ln D\_TTERAS \quad (9)$$

The hypothesis of the model is:

- $H_0 : \alpha_i$  It means that there is no effect of  $i^{th}$  independent variable to the dependent variable (risk averter).  
 $H_a : \alpha_i$  It means that there is an effect of  $i^{th}$  independent variable to the dependent variable (risk averter).

## G. FINDINGS AND DISCUSSION

In all season, the percentage of farmers who avoid the risk (*risk averter*) of the Atlantic variety is more than that of Granola variety. In general, the farmers in all season tends to avoid the risk (*risk averter*) with the most at third cropping season (dry-rainy) (79,167 percent of Granola and 83,636 percent of Atlantic); first cropping season (rainy) (72,917 percent of Granola and 76,363 percent of Atlantic); and at the second season (dry) (55,208 percent of Granola and 72,727 percent of Atlantic). Analyzed in three seasons (in a year), farmers cultivate Granola variety and many of them (69,097 %) avoid the risk and the 77,576 percent of Atlantic variety farmers are the risk averter.

The avoidance behavior among the farm farmers is generally realized by taking the certified seed, expecting for a high productivity, applying more organic and phonska fertilizers to satisfy the NPK needs. This is done to reduce the risk of the fertility decrease because of the erosion and the land sloping. Besides, they also water the plants daily in the drought and control the pest diseases regularly to avoid the pest disease attack.

The factors of farm size, the education of farmers, and other incomes influence to decrease the farmers' avoidance to the risk, meanwhile the level of pest disease attack and productivity risks influence to increase the farmers' avoidance to the risk. The farmers planting Atlantic variety avoid the risk more than those of Granola variety. The farmers applying an impermanent terracing avoid the risk more than those of permanent terracing.

## H. CONCLUSION AND ITS POLICY IMPLICATION

### 1. Conclusion

Most potato farmers in the research field tend to be *risk averter*. The percentage of risk averters among the farmers cultivating the Atlantic variety is more than those among the farmers of Granola



variety. The factors influencing the farmers' avoidance to the risk are the level of pest disease attack and the productivity risk. Meanwhile, the farm size, the education of farmers and other incomes reduce the farmers' avoidance to the risk, meaning influencing farmer's preference to the risk.

## 2. Policy Implication

The development of potato farmin the research location can be done by cultivating the Granolavariety. The percentage of risk averter among the Atlantic variety is more than those among the Granola variety farmers. This is due to the lower income given by the Atlantic than that of Granola. The farmers do not choose the Atlantic because it only promises lower income. Thus, the farmers are suggested to cultivate the potato of Granola variety.

## References

- BPS Kabupaten Banjarnegara. 2009. *Produksi Tanaman Sayuran Dataran Tinggi*. Badan Pusat Statistik Kabupaten, Banjarnegara.
- Cassavant, K. L., and C. L. Infanger. 1984. *Economic and Agricultural Management, An Introduction*. Reston Publishing Company Inc. Virginia.
- de Janvry, A. 1972. The Generalized Power Production Function. *American Journal of Agricultural Economics*, 54 (2) :234-237
- Debertin, D. L. 1986. *Agricultural Production Economics*. Macmillan Publishing Company. New York.
- Foragri. 2009. *Kentang Sebagai Pangan Alternatif*. <http://foragri.blogspot.com/kentang-sebagai-pangan-alternatif/>
- Hardaker, I. B., Huirne, R. B. M. And Anderson, J. R. 1997. *Coping with Risk in Agriculture*. CAB International, New York.
- Moscardi, E. and Alain de Janvry. 1977. Attitudes toward Risk among Peasants: An Econometric Approach: *American Journal of Agricultural Economics*, 59 (4) :710-716
- Olarinde, L. O., V. M. Manyong and J.O. Akintola. 2007. Attitude Towards Risk Among Maize Farmer in The Dry Savana Zone of Nigeria: some respective policies for Improving food production. *African Journal of Agricultural Research*. 2 (8): 399-408
- Roumasset, J.A. 1976. *Risk Aversion, Indirect Utility Function Market Failure* In: Roumasset J.A. Bousard, J.M. Singh I (ed) *Risk and Uncertainty an Agriclturnal Development*, Agricultural Development Council, New York 91-113.
- Salvatore, D. 1993. *Managerial Economics. In Global Economy*. Second Edition. McGraw Hill, Inc All Rights Reserved. United States of America.
- Worldplant. 2010. *Klasifikasi Tanaman Kentang*. <http://worldplant.multiply.com/journal/item/2>
- Yotopoulos, P.A and Nugent, J.B. 1976. *Economics of Development, Emperical Investigation Edition*. Harper and Row, Publishers. Inc. New York.

## THE EFFECTIVENESS OF CLOVE OIL TO CONTROL SOYBEAN RUST DISEASE

<sup>1,2</sup>Sumartini and <sup>1</sup>Eriyanto Yusnawan

<sup>1</sup>Indonesian Legumes and Tuber Crops Research Institute  
PO Box 66 Malang, phone +62-341-801468, facsimile +62-341-801496

<sup>2</sup>Email: sumartiniputut@yahoo.co.id

### Abstract

*Soybean rust disease caused by Phakopshora pachyrhizi is one of the main soybean diseases that causes significant yield loss. Chemical treatments have been carried out to reduce the infection; however, these applications had several negative impacts to the environment. Botanical fungicides offer several advantages, i.e. environmental friendly and less expensive. Eugenol, one of the active ingredients in clove, has been proven effective to control soybean rust disease. Therefore, this study aimed to determine the application time and the effective concentration of clove oil to control the soybean rust. The experiment was conducted at a research station and a green house at Kendalpayak, Malang, East Java. The main plot and the subplot were application time (7, 8 weeks after planting and without spraying) and clove oil concentration (1 ml/l, 2 ml/l and 3 ml/l). All treatments were carried out in triplicates. The time of application was repeated every week and was stopped 2 weeks before harvest. The clove oil application (3 ml/l) starting 7 weeks after planting was effective to control soybean rust disease and reduced the rust intensity of 47.6% and 56.3% for 70 and 77 days after planting.*

**Keywords:** soybean rust disease, clove oil, application time, effective concentration

### INTRODUCTION

Soybean is one the protein sources for Indonesian diet. Many products with affordable price can be made from soybean such as tofu, tempeh, soy milk, and other snacks. Domestic soybean demand tends to increase every year. According to Directorate of Food Crop Indonesia, domestic soybean yield during 2008 was only 775,710 tons. Therefore, the soybean domestic production should be increased. One of the obstacles to increase soybean yield is rust disease infection.

Soybean rust disease caused by *Phakopshora pachyrhizi* is the main soybean disease in Asia (Semangun, 1991). Chemical application using fungicides is an effective control; however, this

effort is not cost effective and not considered environmental friendly. The applications of botanical fungicides have been proven more environmental friendly.

Controls on soybean leaf diseases have been conducted using several botanical extracts. Clove oil was effective to reduce *P. pachyrhizi* infection (Sumartini, 2007). The cloves contained eugenol as an antifungal compound. The eugenol content was 70 – 95% depending on the plant parts and varieties. The range of eugenol in leaves, stalks and flowers were approximately 82-87%, 83-95% and 90-95%, respectively (Guenther, 1990). Metyl eugenol dan  $\beta$ -caryophyllene were also identified in the cloves. The eugenol was a volatile compound which was unable to be dissolved in the water and propylene glycol, however, this compound was soluble in alcohol, ether, chloroform, and acetone (Tombe, 1999). Eugenol antibiotic was effective to control microorganisms such as *Bacillus subtilis*, *Staphylococcus aureus*, and *Escherichia colias* food contaminants. Also, the eugenol suppressed the growth of *Fusarium oxysporum*, *Phytophthora capsici*, *Rhizoctonia solani*, and *Sclerotium rolfsii* (Tombe et al, 1992).

The application of clove extract by spraying (1:10 w/v) at the concentrations of 5%, 10% and 15% inhibited the rust disease. The highest concentration (15%) suppressed the rust disease up to 67.6%. The higher clove extract applied, the less uredia formed, as many as 9, 6 and 3 at the concentrations of 5%, 10% and 15%, respectively. The increase of clove extract application of 2 – 3 folds (from 5% to 10% and 15%) reduced uredia formation of 39% - 64%. However, the effect of the spraying application on soybean yield had not been investigated yet (Sumartini, 2007). This experiment aimed to determine the effective concentration and application time to control soybean rust using clove oil.

### MATERIALS AND METHODS

A research was conducted at Kendalpayak Research Station, in 2009. An experimental design was arranged in a split plot design and all treatments were repeated 3 times. The main plot

was spraying application time (35, 42 days after planting/dap and without spraying) and the sub plot was clove oil concentration (1 ml/l, 2 ml/l and 3 ml/l). The spraying application was carried out every week and stopped 2 weeks before harvest. So, the schedule of the spray applications as follows:

1. 35, 42, 49, 56, 63, 70, and 77 dap
2. 42, 49, 56, 63, 70, and 77 dap
3. without oil clove application.

Clove oil was obtained from the distillation of clove at post harvest laboratory, the Indonesian Medicinal and Aromatic Crops Research Institute.

Orba variety was planted in the field, 4 m x 4 m, distance in rows of 40 cm x 20 cm. Irrigation was performed when necessary. Pest insects were monitored regularly and pesticide applications were applied specific to the targets. For an anticipation of *Bemisia* and army worm attack, neem extract application was carried out.

Rust inoculation was conducted if there was no natural infection at 28 dap. Inoculum was prepared by rubbing spores from infected leaves obtained from the soybean field. Spores were diluted to 10<sup>4</sup>/ml and Tween 80 (as sticker and spreader was added 3 ml/l). Spraying application on the surface of uninfected leaves was conducted in the afternoon (4 pm). As parameters were rust disease intensity at 70 and 77 dap and seed dry weight.

## RESULT AND DISCUSSION

There was an interaction between clove oil concentrations and starting time of spraying application at 70 dap (Table 1). Among all treatments tested, spraying application 3 ml/l starting at 42 days after plantings was the most effective treatment. This result was consistent up to 77 dap. This application was effective to suppress the rust disease intensities from 13.4 to 47.6% and 17.0 to 56.3% at 70 and 77 daps, respectively. This result was better in reducing the disease intensity compared to the application using clove crude extract. The reduction of rust disease intensity by application of the clove crude extract was 17% at Jambegede Research Station during the dry season 2008 (Sumartini, 2009).

The application of the clove oil starting from 35 dap (A1) was not advised because of reducing the yield loss (as indicated on the soybean dry seed weight), 5.4 to 8% but the application of the clove oil starting from 42 dap (A2) was proven to reduce yield loss 0.76% tons/ha (Table 2). Yield loss occurred at early application of clove oil was mainly caused by high intensity of rust disease, not caused by toxic effect of clove oil during application.

A research conducted in a greenhouse and in the field during 2008 showed that the optimum clove oil retention on leaves was five days. However, the inhibition of rust disease infection was only 17% in the field, lower than that in a greenhouse, which was 65% reduction (Sumartini, 2009).

The application of clove oil to reduce soybean rust infection was more frequent (six times of spraying) than that to inhibit soil borne diseases (three times of application) (Djiwanti, and Wiratno, 2011). Clove oil on the leaf surface was more easy to evaporate and prone to UV exposure.

Besides more environmental friendly, the application of clove oil had other advantages such as: a) clove plants were available plenty in Indonesia, b) good odour so not disturbing workers during application. However, the drawbacks of clove oil applications were a) easy to evaporate, therefore the application should be repeated frequently, b) high cost, but cloveoil could be extracted from leaves to reduce the cost production, c) before application, diluted clove oil should be added with surfactant. A research conducted in the US showed that with additional surfactant (a mixture from organic substances), rust intensity on beans could be reduced, and this finding had been patented since 1996 (Anonim,1996).

Table 1. Rust disease intensity of soybean plants treated with clove oil, Kendalpayak Research Station, Malang, East Java, 2009.

Spraying application	B1	B2	B3	Average
	----- (%) -----			
A1	29,2 bc	27,7 b	24,7 a	27,2
A2	28,0 b	30,3 c	25,3 a	27,9
A3	33,7 d	39,3 e	48,3 f	40,4
cv A (%)			6,01	
LSD 0.05 (A)			2,04	
cv B (%)			1,15	
Observation at 77 dap				
Spraying application	B1	B2	B3	Average
A1	41,0 c	33,3ab	32,3 ab	35,5
A2	35,0 b	30,3 ab	29,0 a	31,4
A3	64,3e	59,0d	66,3 e	63,2
cv A (%)			4,27	
LSD 0.05 (A)			4,68	
cv B (%)			2,63	

Explanation:

A1 = spraying clove oil starting from 35 days after planting/dap)

A2 = spraying clove oil starting from 42 dap

A3 = without clove oil application

B1 = 1 ml clove oil/ liter of water  
B2 = 2 ml clove oil/ liter of water  
B3 = 3 ml clove oil/ liter of water  
cv = coefficient variation  
LSD = least significant difference.

Table 2. Dry seed weight of soybean (t/ha) on treated soybean plants with clove oil, Kendalpayak Research Station, Malang, East Java, 2009.

Spraying application	Dry seed weight			Average
	B1 (1 ml/l)	B2 (2 ml/l)	B3 (3 ml/l)	
	----- (t/ha) -----			
A1	2,712	2,912	2,900	2,841
A2	2,795	2,840	3,005	2,880
A3	2,705	2,905	2,965	2,858
Average	2,737 a	2,885 b	2,956 b	
cv A (%)		4,60		
LSD 0.05 (A)		-		
cv B (%)		1,30		
LSD 0,05 (B)		0,158		

Explanation:

A1 = spraying clove oil starting from 35 days after planting/dap)

A2 = spraying clove oil starting from 42 dap

A3 = without clove oil application

B1 = 1 ml clove oil/ liter of water

B2 = 2 ml clove oil/ liter of water

B3 = 3 ml clove oil/ liter of water

cv = coefficient variation

LSD = least significant difference.

## CONCLUSION

Spraying application of soybean plant using clove oil (3 ml/l) starting from 42 days after planting was effective to control rust disease. The reduction of disease intensities was 47.60% and 56.30% at 70 and 77 dap.

## References

Anonim. 1996. *Clove oil as a plant fungicide*.  
<http://www.docstoc.com/docs/49887626/Clove-Oil-As-A-Plant-Fungicide---Patent-5679351>. [17 Oct 2008].

- Djiwanti, S. R. and Wiratno. 2011. *Evaluasi pemanfaatan formula pestisida nabati cengkeh dan serai wangi untuk pengendalian busuk rimpang jahe lebih dari 50%*. P: 213 – 222. In. Prosiding Seminar Nasional Pestisida Nabati IV. Jakarta, 15 October 2011. Balai Penelitian Tanaman Obat dan Aromatik. Pusat Penelitian dan Pengembangan Perkebunan, Badan Penelitian dan Pengembangan Pertanian.
- Guenther, E. 1990. *Minyak Atsiri. Jilid IVB (Penerjemah : S. Ketaren)*. Universitas Indonesia.
- Semangun, H. 2004. *Penyakit-penyakit Tanaman Pangan di Indonesia*. Gadjah Mada University Press. 449 pp.
- Sumartini. 2007. *Efektivitas ekstrak bahan nabati untuk pengendalian penyakit karat (Phakopsora pachyrhizi) pada kedelai*. Jurnal Ilmu Pertanian. Mapeta 9 (2): 70–75. Fakultas Pertanian UPN Veteran. Surabaya.
- Sumartini. 2009. *Retensi minyak cengkeh untuk pengendalian penyakit karat pada kedelai*. Makalah disampaikan pada Kongres dan Seminar Nasional Perhimpunan Fitopatologi Indonesia. Ujung Pandang. 6 pp.
- Tombe M., K. Kobayashi, Ma'mun, Triantoro, dan Sukamto. 1992. *Eugenol dan daun cengkeh untuk pengendalian penyakit tanaman industri*. Makalah disampaikan pada Seminar Review Hasil penelitian Tanaman Rempah dan Obat. Bogor. 8 pp.
- Tombe, M. 1999. *Pengenalan dan Peranan Fungisida Nabati dalam Pengendalian Penyakit Tanaman*. P: 16 – 23. Dalam. Pemanfaatan Pestisida Nabati. Perkembangan Teknologi Tanaman Rempah dan Obat. Vol.11. No. 2. Balai Penelitian Tanaman Rempah dan Obat. 65 pp.

## VEGETATIVE AND GENERATIVE PERFORMANCES OF THREE SOYBEAN VARIETIES IN FIVE LEVELS OF COLCHICINE DOSAGES AND SEED COAT PEELING TREATMENTS

**Sutrisno and Heru Kuswantoro**

Indonesian Legume and Tuber Crops Research Institute  
Indonesian Agency for Agriculture Research and Development  
Jl. Raya Kendalpayak KM 8. PO Box 66 Malang  
E-mail : sutrisnoharun81@yahoo.com

### **Abstract**

*Colchicines is a toxic chemical compound that used to make polyploidy in plant cell. The Polyploid plant generally has a higher performance. This study aimed to evaluate the response of three soybean varieties to colchicine dosages and peeling seed coat treatments. The research was conducted at the greenhouse of Indonesian Legume and Tuber Crops Research Institute in January until May 2013. The design was split plot with three factors and three replications. The first factor consisted of two levels (peeling and unpeeling seed coat), the second factor consisted of three soybean varieties (Tanggamus, Argomulyo, Anjasmoro), and the third factor was consisted of five-levels of colchicine (0 mg/l, 2.5 mg /l, 5 mg /l, 7.5 mg /l, and 10 mg /l). The first factor was arranged as main plot whereas the second and third factor as factorial split plot. The result showed that colchicine and peeling seed coat treatments did not affect vegetative and generative growth. The different response only was affected by genotype. Variety of Tanggamus had the best performance and followed by varieties of Argomulyo and Anjasmoro.*

**Keywords:** soybean, colchicines, seed coat,

### **INTRODUCTION**

Development of new high yielding variety is one of the priorities of the plant breeding programs. One of some techniques that used to get a new genotype is polyploidy, where chromosome is duplicated interfering cell division. Polyploidy will produce a new genotype that has broad character diversity. Polyploidy process can be done in various ways, one of the techniques is a chemical compound application such as colchicines ( $C_{22}H_{25}O_6N$ ).

Colchicines is a toxic chemical compound that can interfere the cell division process. This compound will block spindle strand formation that serves to pull the divided chromosomes to opposite poles. The failure of strand spindle formation leads

the chromosome can not be separated into two poles (Eigsti and Dustin 1955). As a result, number of chromosomes in a cells will duplicate twice or several times more than the previous number. Enhancement the number of chromosomes lead enlargement of plant organ size and plant performance become gigantic. Variability of plants became larger than the previous state (Głowacka *et al.*, 2010). Plants that had greater variability were expected to provide higher yields and better performance (Liu, *et al.*, 2007).

Besides bringing a positive effect, polyploidy plants also was able to produce worse variability than the parent (Shao, *et al.* 2003). Colchicine that has changed the structure of the protein, chromosomal, and other cell components causes disorganized and weak cell activity. Genes become inactive or active but not directed sodamaging cell growth itself. This situation resulted crop growth declining phase, growth structure alteration (Väinölä 2000), a decrease of potential yield, and even to death.

The successful colchicines application in the polyploidy cell is influenced by several factors including dosage, period of application, intensity, and nature of the genotype. Many studies that get differ results depending on the colchicine concentration and application period. Each genotype has a different response to the colchicine treatments. Harbard *et al.* (2012) suggested the best dosage of colchicine for seed treatments ranging from 0.02% at the application time period as long as 16 hours. Kosmiatin and Mariska (2005) stated that mungbean embryo could grow better at a concentration of 0.15% colchicines with incubation period for 2 days. Effective colchicines concentration is in the range of 0.05 - 0.2% with imbibitions time 6 - 24 hours (Lehrer, *et al.* 2008). According to Suryo (1995), the colchicines concentration between 0.001 until 1.00% with a maximum 24 hours immersion period was very effective for cell polyploidy treatment.

The imbibitions rate on seed germination is affected by physical seed coat. The thick coat and narrow pore obstruct colchicines absorption and constrains to enter into the seed. This situation leads the colchicines treatments does not effective. Differences in the physical seed enable different response. Therefore, this study aimed to determine the response of the three soybean varieties at five colchicines levels and seed coat peeling treatments.

## MATERIALS AND METHODS

The research was conducted at the greenhouse of Indonesian Legume and Tuber Crops Research Institute since January until May 2013. The treatment consisted of three factors. The first factor consisted of two levels (with and without seed coat peeling), the second factor consisted of three soybean varieties (Tanggamus, Argomulyo, Anjasmoro), and the third factor was five-level concentrations of colchicine (0 mg/l, 2.5 mg/l, 5 mg/l, 7.5 mg/l, and 10 mg/l). The treatments were 30 combinations. It was set by split plot in randomized completely block design factorial.

Soybean seeds were soaked in fresh water for 24 hours. Most of the seed then was peeled for treatment. The peeled and unpeeled seeds were separated and drained for 30 minutes. Seeds then soaked again in the colchicines solution for 18 hours according to each treatment. Soybean seed was sowed in a sandbox until the age of 14 days. Plants then was transferred to a medium in polybags and was maintained until harvest. NPK fertilizer was applied after being transferred to polybag at 2 days age. Weed control is done according to the weeds situation. Whitefly pest controlling was executed every 3 days. At the same time when the pods begin to form, the plant was supported by using buffer marker to prevent collapsing plant.

Observations were carried out after harvest on maturity days, plant height, number of branches, number of nodes, number of pods, number of unfilled pods, number of seeds per plant, weight of 100 seeds and seed weight per plant.

Data were analyzed by using ANOVA, and if there was a difference in the results of analysis of variance, the analysis was continued by using LSD at 5% significance level.

## RESULTS AND DISCUSSION

Results of anova showed that the seed coat peeling treatment and colchicine levels did not affect vegetative and generative growth of three soybean varieties. Different response occurred among the tested varieties. There was no interaction on peeling

treatment, variety, and dosage of colchicine (Table 1).

The difference level of immersion seed in the colchicine did not affect the growth of soybean plants. Plant height, number of branches, number of nodes, number of pods, seed weight and seed yield were relatively similar at all levels of colchicine treatment. This suggested that colchicine treatment at the level of 0-1 mg/l had not been able to induce cells to polyploidy. As a result, the growth and division cells was normal without affected by colchicine. Consequently, the growth of plant organs such as plant height, number of branches, and seed yield remained in the same range. Similar result also reported by Haryanti *et al.* (2009) that stated that colchicine treatment upto 0.15% did not affect cell growth, number of leaves, plant height, and weight of the mungbean dry matter plant. In contrast, Kosmiatin and Mariska (2005) stated that the colchicines concentration of 0.15% could induced polyploidy on *in vitro* culture of mungbean embryo. The different result of each research showed that cell polyploidy was influenced by the dosage, treatment period, and colchicine application technique.

Seed coat on three tested soybean varieties did not hinder imbibitions process of the colchicine into the seed. It was showed by the similar growth performance of all varieties on both of treatments (Table 1). Similarly, Duclos (2013) reported that the seed coat lemma and palea *Panicum virgatum* L. from upland did not hinder the process of imbibition as long as germination. The thinner soybean seed coat causing colchicine imbibition process did not hampered.

The higher plants variety resulted more number of branches and nodes (Tables 2). The highest plant got more growth space and sunlight lead component of photosynthesis processing more assimilate or photosynthate than short plant variety. Some of the photosynthate then was used to induce new branch. More number of branches produced more number of nodes. Machikowa and Laosuwan (2011) stated that branches had positive correlation with nodes.

The vegetative performance also had positive association with generative performance. Variety of Tanggamus that had the highest vegetative performance also had the highest yield. It was seen in number of filled pods and unfilled pods per plant, number of seeds per plant, and seed weight per plant (Table 3). The similar report was stated by Iqbal that plant height had positive correlation with number of pods, seed, and yield

Table1. Means squares of vegetative and generative performance of three soybean at different dosage of colchicines and peeled seed coat treatments

Source of variances	Plant age	Plant high	Bran-ches	Nodes	Filled pods	Unfilled pods	Number seed	100 seedweight /plant t	Seedweig
Block	0.016	0.073	0.055	0.067	0.255	0.069	0.559	0.005	0.076
Peeling(A)	0.239	2.088	0.049	0.220	0.330	0.749	0.499	0.005	0.422
Error	0.029	0.249	0.096	0.308	0.332	0.083	0.781	0.047	0.335
Varieties (B)	0.555	1.096**	1.467**	6.515**	15.849**	1.826**	22.284**	0.325**	11.713**
AB	0.218	0.227	0.070	0.157	0.246	0.000	0.755	0.069	0.457
Colchicine (C)	0.060	0.039	0.005	0.086	0.257	0.174	0.287	0.071	0.220
AC	0.225	0.147	0.027	0.051	0.134	0.106	0.325	0.053	0.128
BC	0.224	0.109	0.025	0.114	0.143	0.085	0.346	0.050	0.075
ABC	0.260	0.184	0.015	0.126	0.270	0.096	0.421	0.085	0.123
Error	0.267	0.149	0.033	0.125	0.251	0.097	0.430	0.058	0.172
CV (%)	16.64	14.75	13.57	17.09	20.41	21.76	22.15	13.39	19.39

Note; data was transformed with  $\sqrt{(x+0,5)}$

Tabel 2. Means of vegetative performance three soybean varieties

Varieties	Plant age	Plant height	Branch	Nodes
Tanggamus	3.26 a	2.83 a	1.56 a	2.58 a
Argomulyo	2.99 a	2.57 b	1.33 b	1.94 b
Anjasmoro	3.07 a	2.46 b	1.12 c	1.68 c

Note; data was transformed with  $\sqrt{(x+0,5)}$

These results indicated that a good vegetative performance correlated with high yield. Similar results also presented by Liu, *et al.* (2005) that stated that the components of the vegetative form of leaf area, leaf live period, and weight of dry matter was positively correlated to seed yield.

Table 3. Means of generative performance three soybean varieties

Varieties	Filled pods	Unfilled pods	Seed number	100 seed weight /plant	Seed weight /plant
Tanggamus	3.27 a	1.71 a	3.90 a	1.84 a	2.76 a
Argomulyo	2.21 b	1.30 b	2.79 b	1.87 a	2.13 b
Anjasmoro	1.88 c	1.27 b	2.20 c	1.68 b	1.52 c

Note; data was transformed with  $\sqrt{(x+0,5)}$

## CONCLUSION

The colchicine dosage treatments 0 – 10 mg/land seed coat peeling had not been able to initiate polyploidy of the soybean cell as showed by vegetative and generative performance of soybean. The different vegetative and generative

performances were affected by the soybean genotype.

## ACKNOWLEDGEMENTS

We gratefully acknowledged to technician that had helped this research.

## References

- Adams, K. L. and J. F. Wendel (2005). "Polyploidy and genome evolution in plants." Current Opinion in Plant Biology **8**: 135–141.
- Burris, J. S., O.T. Edje, dan A.H. Wahab. 1973. Effects of Seed Size on Seedling Performance in Soybeans: II. Seedling Growth and Photosynthesis and Field Performance. Crop Science Journal **13**: 207–210
- Duclos, D. V., D. T. Ray, et al. (2013). "Investigating seed dormancy in switchgrass (*Panicum virgatum* L.): understanding the physiology and mechanisms of coat-imposed seed dormancy." Industrial Crops and Products **45**: 377–387.
- Eigsti, O. J. and P. Dustin (1955). Colchicine - in agriculture, medicine, biology and chemistry.
- Garcia, A. G. y., T. Persson, et al. (2010). "Response of soybean genotypes to different irrigation regimes in a humid region of the southeastern USA." Agricultural Water Management **97**: 981–987.
- Głowacka, K., S. Jezowski, et al. (2010). "In vitro induction of polyploidy by colchicine treatment of shoots and preliminary characterisation of induced polyploids in two *Miscanthus* species." Industrial Crops and Products **32**: 88–96.

- Guofeng Liu, Zhineng Li, et al. (2007). "Colchicine-induced chromosome doubling in *Platanus acerifolia* and its effect on plant morphology." *Euphytica***157**(1-2): 145-154.
- Harbard, J. L., A. R. Griffin, et al. (2012). "Production of colchicine-induced autotetraploids as a basis for sterility breeding in *Acacia mangium* Willd." *Institute of Chartered Foresters***85**(3): 427-436.
- Haryanti, S., R. B. Hastuti, et al. (2009). "Pengaruh Kolkisin terhadap Pertumbuhan, Ukuran Sel Metafase dan kandungan Protein biji Tanaman kacang Hijau (*Vigna radiata* (L) Wilczek)." *Jurnal Penelitian Sains & Teknologi***10**(2): 112-120.
- Iqbal, S., T. Mahmud, et al. (2003). "Path coefficient analysis in different genotypes of soybean (*Glycine max* (L) Merrill)." *Pakistan Journal of Biological Science***6**(12): 1085-1087.
- Jianzhu Shao, Chunli Chen, et al. (2003). "In vitro induction of tetraploid in pomegranate (*Punica granatum*)." *Plant Cell, Tissue and Organ Culture***75**(3): 241-246.
- Kosmiatin, M. and I. Mariska (2005). "Kultur embrio dan penggandaan kromosom hasil persilangan kacang hijau dan kacang hitam Embryo culture and chromosome doubling of mungbean and black gram hybrid." *Jurnal Bioteknologi Pertanian***10**(1): 24-34.
- Lehrer, J. M., M. H. Brand, et al. (2008). "Induction of tetraploidy in meristematically active seeds of Japanese barberry (*Berberis thunbergii* var. *atropurpurea*) through exposure to colchicine and oryzalin." *Scientia Horticulturae***119**: 67-71.
- Liu, X., J. Jin, et al. (2005). "Yield components, dry matter, LAI and LAD of soybeans in Northeast China." *Field Crops Research***93**: 85-93.
- Machikowa, T. and P. Laosuwan (2011). "Path coefficient analysis for yield of early maturing soybean." *Songklanakarin J. Sci. Technol.***33**(4): 365-368.
- Suryo. 1995. *Sitogenetika*. Yogyakarta: Gadjah Mada University Press
- Väinölä, A. (2000). "Polyploidization and early screening of *Rhododendron* hybrids." *Euphytica***112**(3): 239-244.



## SIMPLE PARTISIPATORY GIS FOR LAHAR HAZARD IDENTIFICATION IN CIMUJA RIVER SUBANG DISTRICT

**Rendi Firdian I<sup>(1)</sup>, Aditya Saputra<sup>(2)</sup>, and<sup>(3)</sup> Priyono**

<sup>(1)</sup> Undergraduate Student of Geography Faculty Universitas Muhammadiyah Surakarta

<sup>(2)</sup> and <sup>(3)</sup> Lecturer of Geography Faculty Universitas Muhammadiyah Surakarta

Email : rendi\_firdian@yahoo.com; Aditya.Saputra@ums.ac.id

### **Abstract**

*This research aims to determine the prone area to lahars hazard surrounding Cimuja river based on the historical event through partisipatory GIS in the research area. The respondent are householders who lived surrounding Cimuja River. The interview result is the distribution of lahar flood high in settlements area. Based on analysis results, Deyeukolot has the highest lahar flood and become the most prone area to lahar hazard in surrounding Cimuja River.*

**Keywords:** Lahars, partisipatory GIS

### **INTRODUCTION**

Indonesia has 80 active volcanoes which continously observed from time to time. According to Sadisun (2008) 50 of them are annually erupted. One of active volcanoes located in West Java is Tangkuban Perahu Volcano. This volcano located around 20 Km in the north part of Bandung City, the capital city of the West Java Province. Based on the administration, this volcano is situated in borderline between West Bandung District and Subang District.

The highest point of Tangkuban Perahu Volcano is 2,084 m above sea level and has Stratovolcano type with the central eruption have moved from east part to west part of the summit. Therefore, this volcano has a lot of sulfure when erupted and sulfure gas when the volcano is in dorman condition.

The volcanic disaster are the phenomena when the volcano erupted and spewing a lot of volcanic material such as lava, hot flare rock, volcanic ash,

toxic gases, and so on. There are also two classification to distinguish the volcanic disaster. Fisrt category is primary hazard. Primary hazard are potential phenomena caused directly by volcanic eruption for example nues ardente, hot flare stone, ash fall, lava flow, and toxic gases, while the secondary hazards are derivatives event caused by volcanic eruption such as lahar, lava dome collapsed, etc.

Lahar flood happened when the material deposit in top of volcanic flank are eroded by the rainfall, therefore in Indonesia lahar hazards are always associated with rainy season. According to Van Bemmelen (1949) and Lavigne (2000) lahar is mudflow, it means the mudflow content a lot of boulder from the volcano, while according to Maruyama (1980) the river morphology has important role for controlling the lahar flood. The objectives of this research are to determine the high of lahar flood in surrounding Cimuja river using partisipatory GIS and try to convert it into hazard zonation of lahar.

### **RESEARCH METHOD**

The research method used is survey and observation in the field through interview several householders who lived in surroundings Cimuja river. This information about the high of lahar flood will be use in analysis how far the lahar flooding in surrounding area using the interpolation method. The interpolation method used is kriging, due to it's accurration. The scoring between interpolation results from simple partisipatory GIS and the condition of river morphology will be scored using particular rule shown in the Table 1.

Tabel 1. Score Rule for Generate The Lahar Hazard Zonation

Flood High (metre)	Slope	flood high Score	Slope Score
0,5	Almost flat	1	5
0,5	Very Steep	1	2
0,5	Steep	1	1
0,7	Gentle	2	4
0,7	Almost flat	2	5
0,7	Steep	2	3
0,5	Gentle	1	4
0,5	Very Steep	1	2
15	Steep	3	3
15	Gentle	3	4
15	Almost Flat	3	5
0,5	Gentle	1	3

## RESULTS AND DISCUSSION

### Lahar Flood High Based on Interview Process

Based on interview results, Dayeukolot Village become the most prone area for lahar, with the highest lahar flood in 107°38'55.738"E 6°40'9.258"S. In this area the settlement are inundated until 0,7 metre from ground. The highest

lahar flood are located in area that are not occupied. This highest lahar flood run into natural forest and plantation, therefore this area will be ignored in analysis. This research focus on settlement areas. The result of Kriging interpolation of lahar flood high can be seen in the Figure 1 below.

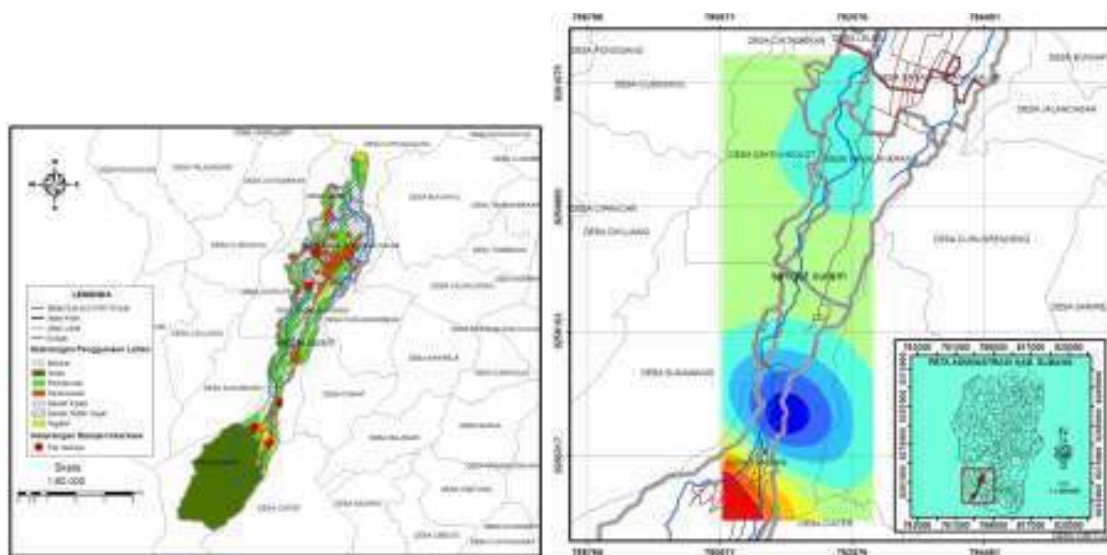


Figure 1. (left) Distribution of Sample for P GIS(Right) Interpolation Results, Red = 15 mLight Green 0 m

### Lahar Hazard Zonation

There are two classes of lahar hazard zonation, prone area to lahar and save area. The prone areas to lahar have the total score between 2

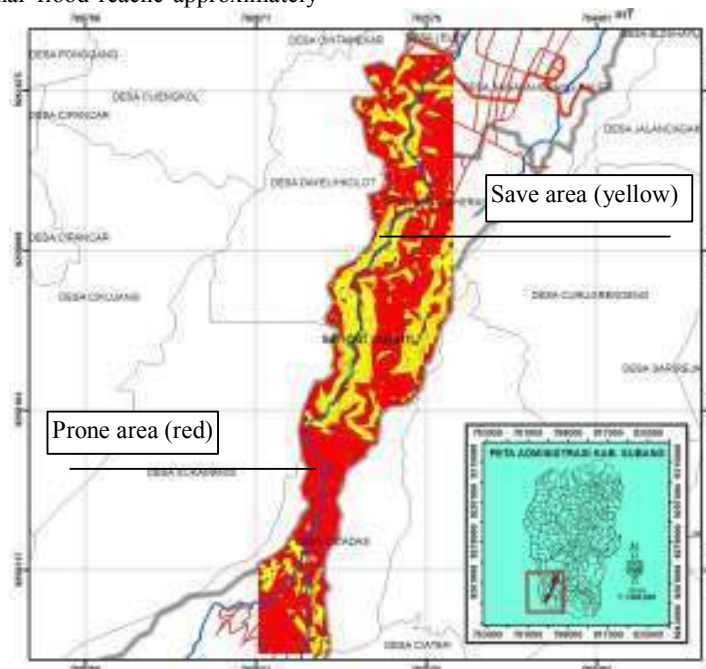
– 5, while the save areas have the total score between 6 – 8. The detailed results can be shown in Table 2

Tabel 2. The Lahar Hazard Zonation Results

Flood High (metre)	Slope	flood high Score	Slope Score	Total Score	Hazard Zonation
0,5	Almost flat	1	5	6	Prone
0,5	Very Steep	1	2	3	Safe
0,5	Steep	1	1	2	Safe
0,7	Gentle	2	4	6	Prone
0,7	Almost flat	2	5	7	Prone
0,7	Steep	2	3	5	Safe
0,5	Gentle	1	4	5	Safe
0,5	Very Steep	1	2	3	Safe
15	Steep	3	3	6	Prone
15	Gentle	3	4	7	Prone
15	Almost Flat	3	5	8	Prone
0,5	Gentle	1	3	4	Safe

Based on the analysis results there are around 373 Ha area were susceptible to lahar hazard. Those susceptible area are distributed randomly in upperstream until middlestream Cimuja river, while the save areas to lahar flood reache approximately

204 Ha. In the further research this safe area will be used for evacuation area if Lahar happens again in the future time. The distribution of lahar hazard zonation can be shown in the Figure 2.



## CONCLUSSION AND SUGESSTION

The most prone area to lahar hazard is located in Dayeukolot village, due to it location and slope condition. In the upperstream area the lahar flood hazard are relatively high and run into natural forest and plantation, therefore this area has low level of susceptibility.

This research was ignored the volcanic material deposite in the summit of volcano. The results was only based on the historical data obtained from partisipatory GIS. This research needs development especially in hazard assessment that have considered the volacanic material deposite and rain characteristic, and also the change of morphology of the river.

## References

- Coburn, W. A., Spence J. R. S., Pomonis A. 1994. *Program Pelatihan Manajemen Bencana*. UNDP Modul Mitigasi Bencana, Edisi ke-2.
- Hartuti, Rine, Evi.2009. *Buku Pintar Gempa*. Yogyakarta : DIVA Press.
- Hendarsah, Haruman. 2012. Penilaian Kerentanan dan Kapasitas Masyarakat dalam Menghadapi Bahaya Banjir Lahar Di Kecamatan Salam Kabupaten Magelang Menggunakan Metode SIGPartisipatif. *Tesis Magister* Yogyakarta : Fak. Geografi UGM.
- LIPI. 2006. *Pengembangan Framework untuk Mengukur Kesiapsiagaan Masyarakat terhadap Bencana Alam*. Jakarta :LIPI-UNESCO/ISDR.
- Maharani, Sholawatul dan Hadmoko, Sri, Danang. 2012. *Pola Adaptasi Penduduk dan Arah Mitigasi pada Daerah Banjir Lahar Hujan di Bantaran Sungai Code*. Jurnal Bumi Indonesia Vol. 1 No. 3. Yogyakarta : Fak. Geografi UGM.
- Munawaroh dan Widiyanto. 2012. *Kajian Persebaran Kerusakan Infrastruktur, Permukiman dan Lahan Pertanian Akibat Banjir Lahar Hujan tahun 2010 dengan Pendekatan Geomorfologi*. Jurnal Bumi Indonesia Vol. 1 No. 3.. Yogyakarta : Fak. Geografi UGM.
- Sadisun, A. Imam. 2008. *Pemahaman Karakteristik Bnecana : Aspek Fundamental dalam Upaya Mitigasi dan Penanganan Tanggap Darurat Bencana*. Paper Gladien Panji Bencana Vol. 12 No. 1. Bandung : Pusat Mitigasi Bencana ITB.
- Tika, Pabundu, Moh, H. 2005. *Metode Penelitian Geografi*. Jakarta : PT. Bumi Aksara.
- Trisakti, B., Teguh, K., dan Susanto. 2008. *Kajian Distribusi Spasial Debit Aliran Permukaan di Daerah Aliran Sungai (DAS) Berbasis Data Satelit Pengindearaan Jauh*. Jurnal Penginderaan Jauh Vol. 7 No.12. Jakarta: LAPAN
- Tyas, C. Dewayani. 2008. *Gunung Meletus dan Antisipasinya*. Semarang : CV. Aneka Ilmu.

## THE ANALYSIS OF KALIUM -40 RADIONUCLIDE POLLUTION AT SEDIMENT, SEA WATER AND SHRIMP (*Penaeus Merguensis*) IN CILACAP COASTAL OCEAN

Wahikun

Dosen Akademi Maritim Nusantara

E-mail: Wahikun\_MS@yahoo.co.id

### Abstract

Research has been carried out using Gamma Spectroscopy method for assessment of existence of Kalium -40 radionuklida activity in sediment, sea water and jerbung shrimp (*Penaeus Merguensis*) in coastal ocean of Cilacap.

The study was conducted at four observation stations began in May 2012 until January 2013, using gamma spectroscopy, except collecting the shrimps taken around station I – III.

The results showed that the activity of Kalium -40 has been emmitted during 8 month interval time are  $(1,88 \pm 0,38) \text{ Bq/kg}$  (sea water) and  $209,51 \pm 48,56 \text{ Bq/kg}$  (sediment) and 0,91. The results also showed that Kalium -40 pollution is more dominated by industrial waste.

**Keywords:** Gamma Spectroscopy, Kalium, Sea water, Sediment, Jerbung Shrimp

### INTRODUCTION

The universe has natural radionuclead (primodial) : U-238, Th-232 and K-40. Kalium -40 has atomic weight 39,098, and the life time  $1,28 \times 10^9$  year. K-40 can be found in stones, soil surface, water and air (NCRP,1987). In the soil K-40 is absorbed in big amount, especially by tumbers. The main source of Kalium is in the earth which contains of acids and minerals. About 3.11% is found in earth and 0.04% is in sea water. K-40 is one of essentials elements which is needed by living things growth, including the biota that tends to absorb K-40 ( Alfian-2010). K-40 pollution is occurred due to effect of TENORM (Technologically Enhance Naturally Occuring Radioactive Materials). According to Fasli (2009) the emmission of K-40 in sediment is higher compared to other elements such as  $\text{Ra}^{226}$  and  $\text{Th}^{232}$ . In Cilacap coastal ocean many industrials such as Holcim (cement), Power Plant, Pertamina Refinery and Harbor, resulting disposal which contain of radionuclead K-40.

Beside the effect of TENORM, K-40 is also can be resulted from fertilizaer such as NPK and TSP that are used by farmer without proper

procedure and then to be carried by river to the sea. In Cilacap waters there is Serayu river which flows pass over the aggriculture area in in four Residents ie Banjarnegara, Purbalingga, Banyumas and Cilacap that might possible the accumulation of K-40 at sea water sediment is occurred.

The purpose of this paper is to analyse how far the existence of radionuclead K-40 which is found in Cilacap coastal waters whether it is still tolerable or worried for water (no. 09/Ka BAPETEN/V - 2009) and shrimps so it is neccessary to be handled or restored. Meanwhile jerbung shrimps is Bentos animal that live in the bottom of water and crawling a sediment so it can be bio indicator of water radionucleid.

Picture 1 show jerbung shrimps which found in Cilacap coastal waters has high economic value. As crustacea, jerbung shrimps is crawling at the bottom of waters, so it acceptable as bio indicator of water and sediment.



Figure 1. Jerbung shrimp

### MATERIALS AND METHODS

#### 1. Location and Resesarch Schedule

Location or station is shown at table 1, and map at Picture 2.

Table 1. Location or research Stations

Stations	South latitude	West longitude
1	7°45'58"	108°59'23"
2	7°44'31"	109°02'24"
3	7°42'26"	109°10'35"
4	7°43'44"	109°20'31"

The detail of map is shown at picture 2.

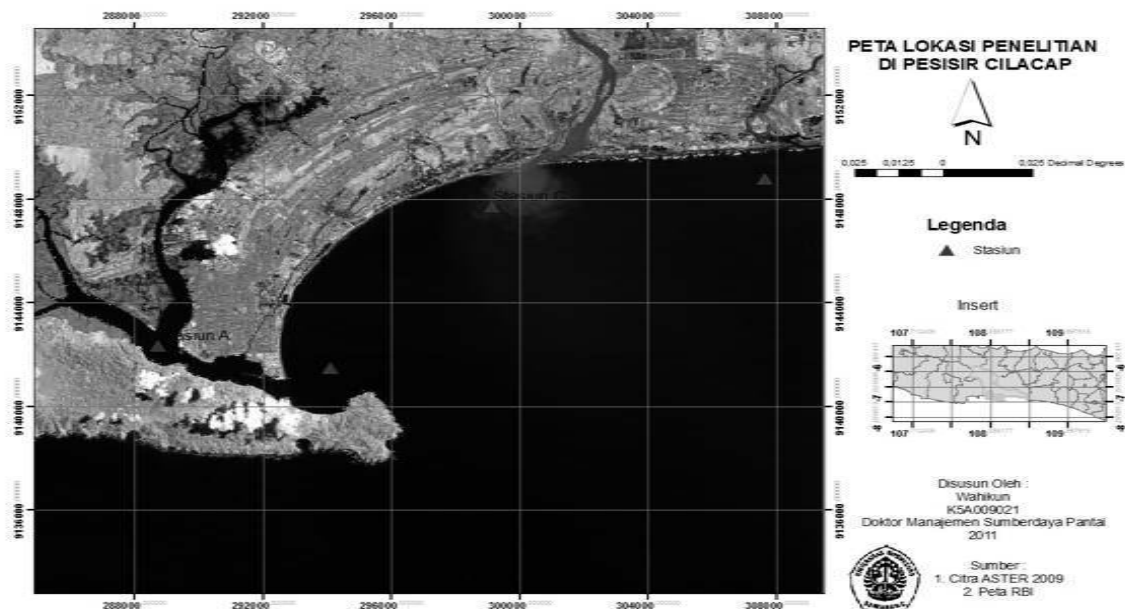


Figure 2. Map of research Station

2. Apparatus
  - a. Comprong boat with balance
  - b. Diving equipment for collecting sediment and seawater
  - c. Bottle (open-close cap) and equiped with rope for collecting water at desirable depth.
  - d. Equipment for collecting sediment
  - e. Net for catching jerbung shrimps
  - f. Refractometer
  - g. pH meter
  - h. Spetrometer gamma
  - i. Liquid nitrogen
  - j. Jerbung shrimp
3. Procedure
  - a. Sampling is done in the morning until noon, 3 time of each sampling
  - b. Seawater at each station is collected at the depth 0.2 h and 0.6 h (h is water depth) 5 .ltr per sample
  - c. Sediment is collected 5 kg each station
  - d. Shrimps are collected at area station 1,2 and 3, using net and the minimum weight of adult shrimps is 40 gr.
  - e. pH must be 0.2 in order to avoid contaminate with other substances.
  - f. Sediment is dried with low temperature (liquid nitrogen)
  - g. The preparation to be done prior analysing with spectrometer

## RESULT AND DISCUSSION

Result of radionuclide anallsys for jerbung Shrimp are 2012 : 0,904 Bq/kgs in September and 2013 0,851 Bq/kgs in January 2013.

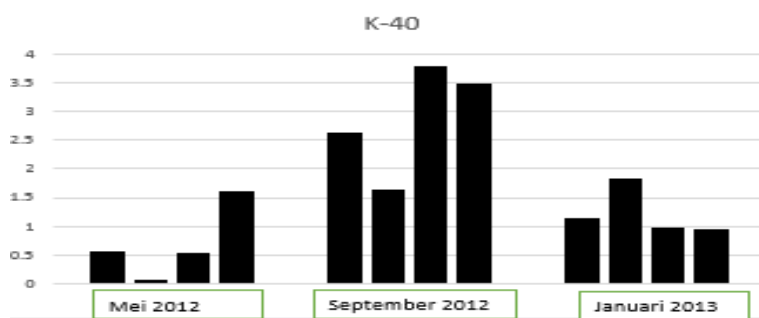
Based on table 2, apperantly that sampling taken in May 2012 showed that kalium-40 activities at water and sedimen relatively is lower compared in September 2012, due to the effect of Serayu river debit that is still flooding. The salinity of the Station I, II and III in May 2012 is lower than in September 2012. Meanwhile at Station IV Kalium - 40 activity is higher than other stations.

Radionuclida activity of kalium -40 at sedimen surface in May 2012 is relatively lower compared to September 2012 ( the peak of dry season)

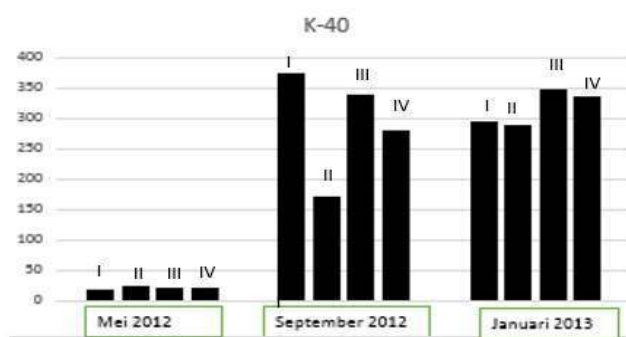
This diagram below in figure 3.a. show that theactivity of kalium -40 in sea water reach the peak in September 2012, activity mean  $\bar{A} = (2,78 \pm 0,61)$  Bq/kg, and in Januari 2013 decreased to be  $\bar{A} = (1,26 \pm 0,41)$  Bq/kg. The debit of Serayu river in September is minimum, since the end of dry season. At the time rare of farmer using fertilizer (Urea), mean while the accumulation of pollution that caused by industrial is maximum, because of no rain. It is indicated that industrial pollution is dominant

Tabel 2. Result of kalium -40 activity analisys for sea water and sediment  
At four station during three times experiments

Parameter	Station	Depth (m)	May 13'12 (Bq/kg)	Sept,02'12 (Bq/kg)	Jan 13'13 (Bq/kg)
Sea Water	I	3,40	0,432	2,621	1,399
		10,20	0,722	2,216	0,893
	II	1,85	0,029	1,591	1,830
		5,52	0,087	1,703	1,839
	III	2,75	0,144	5,928	1,064
		8,20	0,944	1,619	0,865
	IV	1,20	1,612	3,841	0,958
Sediment	I	17,00	16,932	324,50	295,70
	II	9,20	24,833	169,5	288,99
	III	13,80	13,819	340,2	349,01
	IV	6,00	20,370	279,3	335,81



(a)



(b)

Figure 3. chart of kalium -40 activity in sea water and sediment

Picture 3.b. describe Kalium -40 activity in sedimen. The optimum increasing occure between May 2012 until September 2012, in the mean time between September 2012 until januari 2013 occur the increasing but not significant.

Based on Head of Badan Tenaga Atom decree no atom nomor 02/Ka/Bapeten/V-99 regarding the envirotnmen standard, the limitation

dissolved in sea water is  $7 \times 10^2$  Bq/liter, and non dissolved is  $1 \times 10^2$  Bq/liter. So that the kalium - 40 in Cilacap coastal waters is safe, and under limitation of environment.

The activity of Kalium -40 at sedimen between September 2012 and Januari 2013 tend to little increase. In September the mean activity

(278,4 ± 11,6) Bq/kg, and in januari 2013, the mean activity is (317,3 ± 14,5) Bq/kg.

The mean (average) of Kalium -40 activity in Jerbung shrimp is 0,877 Bq/kg, and according to regulation of IAEA(1996) is safe.

In term of the effect to biota (and men) so the amount absorption dose must be calculated that is absorption dose in a year in Sievert (Sv).

According to IAEA regulation Basic Safety Standard 115/1999 declare that allowed dose for environment is 1 mSv/year. And the dose of foods, according to WHO/FAO regulation is 5 mSv/year. As the illustration, a person who always consumed continuously 70 kgs of shrimp in a year. so that Kalium -40 activity are  $A_K = 126$  Bq. or if in Curie. is  $A_K = 1708,56 \times 10^{12}$  Ci.

The absorption dose  $1 R = 2,58 \times 10^{-3}$  Ci/kg, Quality factor gamma ray  $Q = 1$  then absorption dose in a year  $1,32 \times 10^{-8}$  Sv or  $1,32 \times 10^{-5}$  mSv. there is much lower than 5 mSv so saved to be consumed by people.

The habit of kalium -40 at sedimen is different with Radium -226 which is shape decreased in januari 2013 (station I, II, and IV) compared with kalium -40 (station I). It is indicated that the influence of Serayu River stream is only at station I.

## CONCLUSION

The activity of kalium -40 has been found in sea water, sediment and jerbung shrimp in Cilacap coastal waters. The research is carry out since May 2012 until January 2013 indicated there is kalium -40 activity increased. In sea water, mean kalium 40 activity, in the beginning (May 2012) that showed 0,565 Bq/kg was to be 1,96 Bq/kg (January, 2013) or 232 %.

At sediment, mean of kalium- 40 in the beginning (May, 2012) that showed 18,98 Bq/kg (May, 2012) was increased to be 356 Bq/kg or 1534 %. At jerbung shrimp, the mean of kalium -40 activity was remain 0,878 Bq/kg, so that is safe to environment, but the increasing of kalium -40 activity at sea water and sediment to be attentively.

## RECOMMENDATION

1. It is necessary to hamper the increasing of kalium -40 activity at sedimen, and industrial growth which is used the raw material and its process that emit kalium -40.
2. It is necessary the further research that is more valid and that is enable to find the industry which resulting the emission of kalium -40.

## References

- Alfiyan, M dan Akmad RY, 2010, *Perangkat Lunak Resrad-Biota Sebagai Alat Bantu Dalam Pemantauan Lingkungan (Studi Kasus: Estimasi Radiologik Biota Di Sekitar Instalasi Nuklir Serpong)*, Prosiding Seminar Nasional ke-16 Teknologi dan Keselamatan PLTN Serta Fasilitas Nuklir, 2010.
- Bolsunovsky, A, 2009, *The effect of radionuclide and heavy metal contamination of the Yenisei River on cytogenetics of aquatic plant Elodea Canadensis*, Radioprotection, vol. 44, no 5 (2009) 83–88
- Ismali, F.A 2009, *Radiological Studies Of Naturally Occuring Radioactive Materials in Some Malaysia's Sand Used In Building Construction*. The Malaysian Journal of Analytical Sciences, Vol 13 No 1 (2009): 29 – 35
- International Atomic energy agency (1999), Basic Safety Standard for food and International Basic Safety Standard for . Protection Against Ionizing Radiation and For Safety Of Radiation Source (IAEA1996). [www.pub.iaea.org](http://www.pub.iaea.org).
- NCRP, 1987, Environmental Radiation Measurement, Recommendation Of the National Council on radiation Protection and measurement, NCRP Report No. 50.
- OESTERHUIS, L., 1992, *Radiological Aspects of the Non-Nuclear Industry in the Netherlands Radiation Protection Dosimetry*,
- Wahikun, 2013, *Kajian Tentang Peningkatan Aktivitas Radionuklida Radium -226 Pada perairan Pesisir Cilacap dengan metoda spektroskopi gamma*, Prosiding seminar Pengembangan Sumberdaya Pedesaan dan Kearifan Lokal berkelanjutan III, 26 – 27 November 2013, LPPM Unsoed Purwokerto.



## THE EFFECT OF RHIZOBIUM INOCULATION ON TOTAL FLAVONOID, PHENOLIC CONTENTS, AND ANTIOXIDANT ACTIVITY OF SOYBEAN SEEDS

Eriyanto Yusnawan

Indonesian Legumes and Tuber Crops Research Institute  
Jalan Raya Kendalpayak KM 8 Kotak Pos 66 Malang, East Java, Indonesia  
Email: yusnawan@yahoo.com

### Abstract

*Soybean contains secondary metabolites which benefit to soybean's life cycle as well as provide human health benefit. Flavonoids which are one of the phenolic groups in legumes are beneficial for the crops as UV protectant, defense against plant pathogen infections, and signal molecules to symbionts. This study aimed to investigate the effect of the inoculation of soybean with rhizobium on the secondary metabolites (total flavonoid and phenolic contents) and antioxidant potential of its seeds. Inoculation with rhizobium on nine Indonesian soybean varieties generally increased total phenolic contents, from 8.1% to 19.0%. Only Detam 2 variety showed slight reduction in phenolic contents (-1.2%). Total flavonoid contents also increased after rhizobium application, from 0.3% to 5.5%, except for Sinabung and Sibayak. These two varieties had 0.9% and 2.6% flavonoid content reduction. Similar to phenolic and flavonoid contents, antioxidant activity also increased by 1.2% to 15.2%, except for Tanggamus, Sibayak, and Detam 2. Rhizobium inoculation could be used as a biotic elicitor to increase soybean secondary metabolite production. Soybean seeds containing high secondary metabolites may be more resistant to plant pathogens as well as have potential benefit to human health.*

**Keywords:** soybean, rhizobium inoculation, flavonoids, phenolics, antioxidant activity.

### BACKGROUND

Soybean (*Glycine max*) is one of the primary sources of protein which is considerably low cost for Indonesian diet. Domestic soybean demand has increased every year. According to Indonesian Statistical Bureau (2010), soybean demand has been projected to 2.3 million tons by 2014. Efforts to increase soybean productivity have been continually conducted. Increasing productivity by adding input of beneficial microorganisms is one of

the ways to achieve soybean self sufficient program targeted by Indonesian government.

Similar to other legumes, soybean has ability to fix nitrogen when this crop can establish a mutual symbiotic with soil nodulating bacteria belonging to the Rhizobiales order. This symbiotic makes the chance of the normal growth and development of soybean in poor nitrogen soil (Heldt, 2005). The advantages of rhizobium application are able to increase soil fertility naturally and considerably low cost.

Soybean contains beneficial secondary metabolites both for plant's life cycle and for human health. The secondary metabolites differ from the primary metabolites since these compounds are generally considered not essential to basic plant metabolism (Boue *et al.*, 2009). Most of the secondary metabolites are synthesized from various plant pathways, including the isoprenoid, phenylpropanoid, alkaloid, or fatty acid/polyketide pathways (Boue *et al.*, 2009, Couto *et al.*, 2011).

Flavonoids which are one of the phenolic groups in legumes are ubiquitous and beneficial for the crops as UV protectant, flower pigments, defense against plant pathogen infections, and signal molecules to symbionts (Boue *et al.*, 2009). The interaction of rhizobium and soybean roots is initially regulated by these compounds.

The benefits of soybean flavonoids to control some soil borne pathogens have been reported by Kramer *et al.* (1984) and Weidenborner *et al.* (1990). Besides having antimicrobial properties, the secondary metabolites provide beneficial effects to human health including reducing the risk of cancer (Adlercreutz, 1990, Baird *et al.*, 1995, Fournier *et al.*, 1998, Tham *et al.*, 1998, Wu *et al.*, 1996). This study aimed to investigate the effect of the inoculation of soybean with rhizobium on the secondary metabolites (flavonoid and phenolic contents) and antioxidant potential of its seeds.

### MATERIALS AND METHODS

**Planting and rhizobium inoculation.** Nine soybean seed varieties, i.e. Ringgit, Wilis, Jayawijaya, Sinabung, Kaba, Tanggamus, Sibayak,

Lawit, and Detam 2 were treated with *Rhizobium* sp. Each variety was sowed in three pots, two seeds per pot and repeated three times. The coated seeds were showed, two seeds per pot. Another set of experiment was planted separately without seed coating of rhizobium.

**Sample preparation.** Seeds harvested from the sets of rhizobium inoculation and non inoculation were ground to obtain 80 mesh-particles (Xu and Chang, 2007, 2008). Extraction was conducted using 80% methanol as a solvent.

**Determination of total flavonoid content.** Total flavonoids were determined using  $AlCl_3$  method (Heimler *et al.*, 2005). Absorbance values were measured using spectrophotometer at 515 nm. The results were express as micrograms of (+)-catechin equivalents (mg of CAE/g sample) using the calibration curve of (+)- catechin.

**Determination of total phenolic content.** Total phenolic contents were determined according to a method developed by Singleton and Rossi (1965) and Singleton *et al.* (1999). Absorbance values were measured spectrophotometrically at 750 nm. Total phenolic contents were express as gallic acid equivalents (mg GAE/g sample) using the calibration curve of gallic acid.

**Radical DPPH scavenging activity.** Antioxidant activity of the seed extract was determined with 2,2-diphenyl-1 picrylhydrazyl (DPPH) according to Chen and Ho (1995). Soybean extract was diluted in 0.1 mM DPPH (1:19 v/v). The solution was homogenized and incubated at a dark room for 30 min. Absorbance values of the samples, control and blank were measured at 515 nm. The free radical scavenging activity of legume extracts was expressed as milimoles of Trolox equivalent (mmol TE) per gram sample.

## RESULTS AND DISCUSSION

Total flavonoid contents of rhizobium and non rhizobium treatments varied from 0.59 mg CAE/g to 1.29 mg CAE and from 0.58 mg CAE/g to 1.25 mg CAE/g, respectively (Figure 1). In general, soybean seeds harvested from the rhizobium treatment contained more flavonoid contents than those of the counterpart, even though the increase was only at around 0.3% to 5.5%, except for Sibayak and Sinabung varieties (Table 1). The flavonoid contents of these two varieties slightly decreased (-2.6% and -0.9%). Four varieties i.e. Wilis, Jayawijaya, Tanggamus, and Sinabung showed less responsive in the increase in flavonoid contents.

Interestingly, Detam 2, a soybean variety which had black seed coat, had total flavonoid

content almost two folds than that of yellow seed coat which was observed in the other eight soybean varieties. Detam 2 seeds obtained from rhizobium treatment had 2.9% more total flavonoid content than the non treated one.

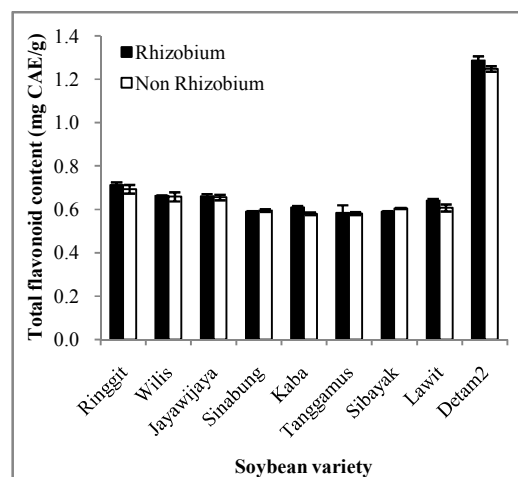


Figure 1. Total flavonoid content (mg CAE/g) of nine soybean seed varieties with and without inoculation of rhizobium. Bars represent standard deviations.

The range of total phenolic contents extracted from seeds harvested from rhizobium inoculation and non rhizobium inoculation were from 2.6 mg GAE/g to 3.8 mg GAE/g and from 2.5 mg GAE/g to 3.9 mg GAE/g (Figure 2). Compared with non rhizobium treatment, seeds obtained from rhizobium inoculation generally had more total phenolic contents. The increase of these compounds was 8.1% to 19%, in which Sinabung was the highest (Table 1).

Unlike in the case of flavonoid content which increased after rhizobium inoculation, Detam 2 decreased in the total phenolic content as many as -1.2% (Table 1). This occurrence was not found in the yellow seed coat soybeans. Tanggamus was only the variety which was not changed in total phenolic content after rhizobium nodulation. Total phenolic content of the black seed coat soybean was only about 1.5 folds than that of the yellow seed coat soybeans.

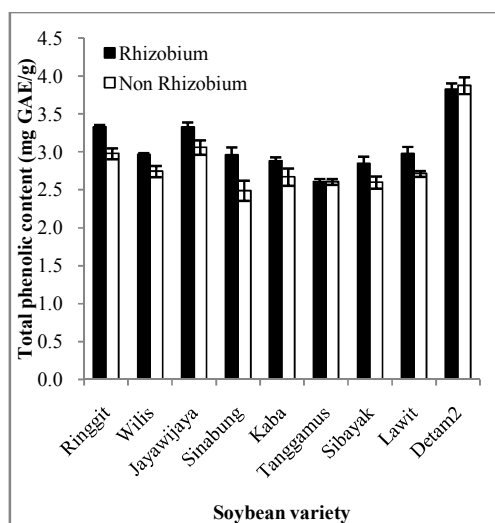


Figure 2. Total phenolic content (mg GAE/g) of nine soybean seed varieties with and without inoculation of rhizobium. Bars represent standard deviations.

It is generally accepted that antioxidant activity in legumes were closely related to high phenolic contents. DPPH is one of the free radicals that can be used to measure the scavenging efficiency of the sample by measuring the degree of discoloration of the DPPH solution. Antioxidant activities as indicated by DPPH scavenging activity of the nine soybeans were from 5.9 mmol TE/g to 15.1 mmol TE/g and from 6.0 mmol TE/g to 16.3 mmol TE/g for rhizobium treatment and non rhizobium treatment, respectively (Figure 3).

The black seed coat soybean, Detam 2, had the antioxidant activity more than double than that of yellow seed coat soybeans (Figure 3). There were two soybean varieties (Ringgit and Lawit) which had the increase in the antioxidant activity more than 10% after rhizobium nodulation (Table 1). Three soybean varieties (Tanggamus, Sibayak, and Detam 2) decreased in antioxidant activity.

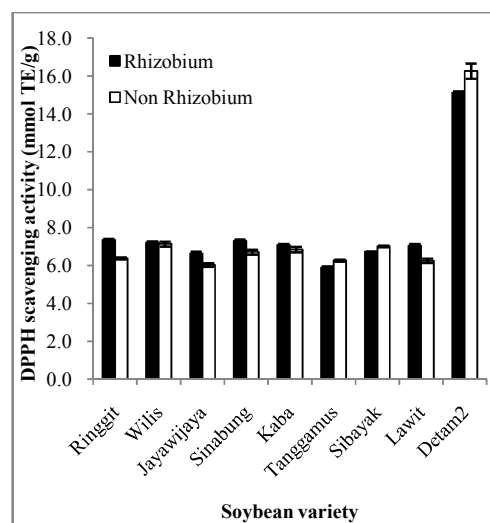


Figure 3. Radical DPPH scavenging activity (mmol TE/g) of nine soybean seed varieties with and without inoculation of rhizobium. Bars represent standard deviations.

In some soybean varieties, the high increase in phenolic contents was not linearly correlated with the high increase in the antioxidant activity, as observed in Wilis and Lawit (Table 1). Different responses of increasing in phenolic and flavonoid contents as well as antioxidant activity may be influenced by genetic factors.

Table 1. Change in total flavonoid, phenolic contents and antioxidant activity of nine soybean seed varieties.

Soybean variety	Percentage of the change of		
	Flavonoid content	Phenolic content	Antioxidant activity
Ringgit	2.9 abc	11.8 b	15.2 a
Wilis	0.9 bcd	8.1 b	1.2 d
Jayawijaya	0.8 bcd	8.9 b	9.8 bc
Sinabung	-0.9 cd	19.0 a	8.8 c
Kaba	4.8 ab	8.1 b	3.5 d
Tanggamus	0.3 bcd	0.0 c	-5.7 e
Sibayak	-2.6 d	9.6 b	-4.1 e
Lawit	5.5 a	9.6 b	12.6 ab
Detam 2	2.9 abc	-1.2 c	-7.0 e

Negative values show the reduction of the contents. Values followed by the same letters in the same columns are not significantly different (LSD,  $\alpha = 5\%$ )

The contents of soybean secondary metabolites could be enhanced by several biotic elicitors (Boue *et al.*, 2009). The increase in total flavonoid and phenolic contents as observed in this study was not surprising. This finding was in agreement with a study conducted by Couto *et al.*

(2011) which showed that nodulation caused by *Bradyrhizobium japonicum* tent to an increase in phenolic compounds and organic acids of aerial parts of soybean plants including leaves and stems.

In general, seed extracts obtained from rhizobium inoculation exhibited significant higher antioxidant activity. This finding supported a result of a study conducted by Couto *et al.* (2011). In their study, higher antioxidant activity was examined in leaves and stems of soybean plants nodulated by *B. japonicum*. In plants, the increase in antioxidant activity may be one of the indications of a response of plants to protect cells from reactive oxygen species which was mostly found during the development of plant pathogen in plant tissues (Pritchard *et al.*, 2000).

The increase in total flavonoid, phenolic contents, and antioxidant activity of soybean seeds may have two advantages both for plant's life cycle and potential for human health. Phenolic compounds and flavonoids play an important role in defense strategies against pathogens and insect attacks. Also, these chemicals have allelopathic properties and ultraviolet protectants (Jaganath and Crozier, 2010). Studies the role of flavonoids to protect soybean plants from soil borne pathogens, *Rhizoctonia solani*, *Sclerotium rolfsii*, and *Fusarium culmorum* were reported by Kramer *et al.* (1984) and Weidenborner *et al.* (1990).

In recent years, the role of both phenolic compounds and flavonoids as health promoting constituents has become an increasingly important area of human nutrition studies. Prolong consumption of foods containing phenolic and flavonoid compounds has been proven to prevent or reduce the risk of degenerative diseases and other diseases related to estrogenic deficiency (Adlercreutz, 1990, Baird *et al.*, 1995, Fournier *et al.*, 1998, Tham *et al.*, 1998, Wu *et al.*, 1996). The increase in secondary metabolites could be manipulated by inoculation with rhizobium, as exhibited in this study.

## CONCLUSION

Inoculation with nodulating rhizobium may be employed to enhance total flavonoid, phenolic contents, and antioxidant activity especially on yellow soybean seeds.

## References

Adlercreutz, H. 1990. Western diet and Western diseases: Some hormonal and biochemical mechanisms and associations. *Scandinavian J. Clin. Lab. Inves.*, 50, 3-23.

- Baird, D.D., Umbach, D.M., Lansdell, L., Hughes, C.L., Setchell, K.D., Weinberg, C.R., Haney, A.F., Wilcox, A.J. and McLachlan, J.A. 1995. Dietary intervention study to assess estrogenicity of dietary soy among postmenopausal women. *J. Clin. Endocr. Metabol.*, 80, 1685-90.
- Boue, S.M., Cleveland, T.E., Carter-Wientjes, C., Shih, B.Y., Bhatnagar, D., McLachlan, J.M. & Burow, M.E. 2009. Phytoalexin-enriched functional foods. *J Agric. Food Chem.*, 57, 2614-2622.
- Chen, C. and Ho, C. 1995. Antioxidant properties of polyphenols extracted from green and black teas. *J. Food Lipids*, 2, 35-46.
- Couto, C., Silva, L.R., Valentao, P., Velazquez, E., Peix, A., and Andrade, P.B. 2011. Effects induced by the nodulation with *Bradyrhizobium japonicum* on *Glycine max* (soybean) metabolism and antioxidant potential. *Food Chem*, 127, 1487-1495.
- Fournier, D.B., Erdman, J.W. and Gordon, G.B. 1998. Soy, its components, and cancer prevention: a review of the in vitro, animal, and human data. *Cancer epidemiology, biomarkers and prevention: a publication of the American Association for Cancer Research*, cosponsored by the American Society of Preventive Oncology, 7, 1055-65.
- Heimler, D., Vignolini, P., M.G., and Romani, A. 2005. Rapid tests to assess the antioxidant activity of *Phaseolus vulgaris* L. dry beans. *J. Agric. Food Chem.*, 53, 3053-3056.
- Heldt, H.W. 2005. *Plant Biochemistry*, 3rd ed. London: Elsevier Academic Press.
- Indonesian Statistical Beaureau. 2010. Indonesian Statistic. Indonesian Statistical Beaureau.
- Jaganath, I.B and Crozier, A. 2010. Dietary Flavonoids and Phenolic Compounds. In C.G. Fraga (ed.). *Plant Phenolics and Human Health: Biochemistry, Nutrition, and Pharmacology*. John Wiley and Sons, Inc. 1-49 pp.
- Kramer, R.P., Hindorf, H., Jha, H.C., Kallage, J. and Zilliken, F. 1984. Antifungal activity of soybean and chickpea isoflavones and their reduced derivatives. *Phytochemistry*, 23, 2203-2205.
- Pritchard, S.G., Santen, E.V., Qiu J., Weaver, D.B., Prior, S.A., and Roger, H. 2000. The Influence of elevated CO<sub>2</sub> on the activities of antioxidative enzymes in two soybean genotypes. *Aust. J. Plant Physiol.* 2: 1061-1068.

- Singleton, V.L. and Rossi, J.A. 1965. Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagents. *Am. J. Enol. Vitic.*, 16, 144-158.
- Singleton, V.L., Orthofer, R. and Lamuela-Raventos, R.M. 1991. Analysis of total phenols and other oxidation substrates and antioxidants by means of Folin-Ciocalteu reagent. In: Lester, P. (ed.) *Methods in Enzymol.* Academic Press.
- Tham, D.M., Gardner, C.D. and Haskell, W.L. 1998. Potential health benefits of dietary phytoestrogens: a review of the clinical, epidemiological, and mechanistic evidence. *J. Clin. Endocr. Metabol.*, 83, 2223-2235.
- Weidenborner, M., Hindorf, H., Chandra, J.H., Tsotsonos, P. and Egge, H. 1990. Antifungal activity of isoflavonoids in different reduced stages on *Rhizoctonia solani* and *Sclerotium rolfsii*. *Phytochemistry*, 29, 801-803.
- Wu, A.H., Siegler, R.G., Horn-Ross, P.L., Nomura, A.M., West, D.W., Kolonel, L.N., Rosenthal, J.F., Hoover, R.N. and Pike, M.C. 1996. Tofu and risk of breast cancer in Asian-Americans. *Cancer Epidemiol. Biomarkers Prev.*, 5, 901-906.
- Xu, B. and Chang, S.K.C. 2007. A Comparative study on phenolic profiles and antioxidant activities of legumes as affected by extraction solvents. *J. Food Sci.*, 72, S159-S166.
- Xu, B. and Chang, S.K.C. 2008. Antioxidant capacity of seed coat, dehulled bean, and whole black soybeans in relation to their distributions of total phenolics, phenolic acids, anthocyanins, and isoflavones. *J. Agric. Food Chem.*, 56, 8365-8373.

## SCREENING OF MUNGBEAN MUTANT GENOTYPES RESISTANT TO POWDERY MILDEW (*Erysiphe polygoni*) AND LEAF SPOT DISEASE (*Cercospora canescens*)

Sumartini <sup>1)</sup>, Yuliastuti <sup>2)</sup>, Eriyanto Yusnawan <sup>1)</sup>

- 1) Indonesian Legumes and Tuber Crops Research Institute. PO Box 66 Malang, phone +62-341-801468, fax +62-341-801496
- 2) Indonesian Atomic Institute

### Abstract

A resistant evaluation of mungbean mutant lines to powdery mildew (*Erysiphe polygoni*) and leaf spot (*Cercospora canescens*) was conducted in a greenhouse at Indonesian Legumes and Tuber Crops Research Institute (ILETRI) during January to March 2011. Nine mungbean mutant genotypes obtained from Indonesian Atomic Institute were evaluated for the resistance to those two diseases. The infections were artificially inoculated for leaf spot disease and naturally infected for the powdery mildew. Disease intensity was monitored at 42 and 49 days after planting. The mutant genotypes resistance to powdery mildew and leaf spot were determined by using AVRDC methods. The disease intensity of the leaf spot and the powdery mildew varied from 16 – 48% and 5–50% at the end of the observation. Among the nine mutant genotype tested, the PsJ-S-30 was more resistant to powdery mildew and moderately resistant to leaf spot, also the dry seed weight was higher than that of check varieties (Gelatik, Perikutut, and Vima-1).

**Keywords:** mungbean, resistance, powdery mildew, leaf spot

### INTRODUCTION

Mungbean is one of the protein sources in Indonesian diet. Mungbean was processed in confectionary industries. Also, mungbean was as one of the raw materials in traditional food processing, such as bakpia, onde-onde, and mungbean porage. Therefore, mungbean domestic production should be increased. Indonesia is the third mungbean production country after India and Taiwan. One of the obstacles of mass mungbean production is pathogen infections. Powdery mildew and leaf spot diseases are the main diseases of this crop. The occurrence of powdery mildew on mungbean is mainly during dry season, on the other hand, the leaf spot disease is during raining season.

**Powdery mildew.** This disease is caused by *Oidium* sp. The perfect stage of fungal growth is

*Erysiphe polygoni*. Powdery mildew is one of the main diseases and a problem in national mungbean production (Semangun, 2004; Hardaningsih, Baliadi, and Saleh, 1992). This disease was also reported in countries where the mungbean was produced, i.e. India, Philippine and Taiwan (Quebral, 1978 and Yang, 1978). When the disease covers all leaves during flowering, the yield loss was around 21% (Quebral, 1978). Prayogo dan Hardaningsih (1993) reported that in a susceptible genotype (no. 129), the yield loss because of *E. polygoni* infection in early plant growth (14 days after planting) plants was approximately 80%.

**Leaf spot disease.** The disease widely spreads throughout Indonesia and the intensity is mild to severe. The disease was also discovered in Malaysia, Filipina, Thailand, dan Pasific islands (Semangun, 2004). The yield loss was reported up to 23% in 75% infected leaves caused by *Cercospora* in Philippine (Quebral, 1978), and in Taiwan was reported up to 58% (AVRDC, 2005). Two fungi were identified as the cause of the leaf spot, i.e. *Cercospora canescens* and *Cercospora cruenta*, however, *C. canescens* was more common in the fields than the other.

Fungicide applications were effective to control powdery mildew. A spray application employing benomil (30 g/100g) at least twice in every 14 days or an application by mixing benomil in soil around root areas or sulfur spraying (3 kg/ha) every 10 days starting from early symptoms were also effective to control this pathogen (Quebral, 1978 and Yang, 1978). So far, mungbean was planted in the field with traditional technology. Mungbean disease controls especially using fungicides were rarely conducted because of low socio-economic of the farmers.

One of the breakthroughs in controlling powdery mildew and mungbean leaf spot is planting resistant varieties. The use of resistant varieties had been proven as economical practice and simple (Hardaningsih, 1992). Mutation was an approach to produce mungbean varieties with

superior characteristics such as high yield and resistance to biotic and abiotic stress (Micke, 1983 and Singh, 1986). Evaluation of mutant genotypes was conducted to obtain the superior varieties in terms of resistance to powdery mildew and leaf spot disease. This research was carried out to obtain mutant lines resistant to those two diseases. The mutant genotypes were supplied by the Indonesian Atomic Institute.

## MATERIAL AND METHODS

This research was conducted in a green house at Indonesian Legumes and Tuber Crops Research Institute (ILETRI) Malang during January to March 2011. The experiment was arranged in a completely randomized design with four replicates. Nine mungbean mutant genotypes were employed and three national varieties were selected as a comparison (Gelatik, Perkutut, and Vima-1).

Mungbean seeds were planted in plastic pots ( $\Phi = 40$  cm) filled with sterile media consisting of soil, cow manure and compost (1:1:1 v/v/v).

Artificial inoculation with leaf spot pathogen was conducted three weeks after planting and powdery mildew occurred naturally. The leaf spot inoculums were collected from infected mungbean leaves from Muneng research station in Probolinggo. The infected leaves were transported to the mycology laboratory, ILETRI. The infected leaves were washed with tap water and placed in trays wrapped with plastic to maintain the humidity and the leaves were incubated for a day. *C. canescens* spores were collected with a painting brush. The spores were diluted to  $10^4$  in water. Inoculation on mungbean healthy leaves was conducted in the evening. The plants were covered with plastics to maintain high humidity.

Disease intensities of leaf spot and powdery mildew were measured. Leave areas covered by leaf spot and powdery mildew (0 – 100%) were monitored and scored. The resistance of mungbean to leaf spot and powdery mildew was measured according to a method adopted from AVRDC (1990) as follows:

Explanation		Resistant category
1.	0	HR (highly resistant)
2.	1 - 10% leaves covered by powdery mildew	R (resistant)
3.	11 - 30% leaves covered by powdery mildew	MR (moderate resistant)
4.	31 - 60% leaves covered by powdery mildew	MS (moderate susceptible)
5.	61 – 80% leaves covered by powdery mildew	S (susceptible)
6.	>80% leaves covered by powdery mildew	HS (highly susceptible)

As parameters were a) leaf spot disease intensity, b) powdery mildew intensity, c) numbers of seeds/pod, and d) seed weight.

## RESULTS AND DISCUSSION

The growth of all mutant mungbean genotypes was normal until 30 days after planting (dap). Leave colour was the same as that of the national varieties on the early growth stage, however, the leave colour changed darker as the plants grew older. A week after leaf spot inoculation, the symptom appeared as small spots and wider

afterwards. Leaf spot disease intensities varied from 5.0% to 41.2% and from 16.5% to 48.7% after 42 and 49 dap. The resistant varied from moderately resistant to moderately susceptible at 49 dap. PsJ-S-30 and PsJ-S-31 were categorized moderately resistant, whereas, the other mutant genotypes were moderately susceptible (Table 1).

Table 1. Leaf spot disease intensity on mungbean mutant genotypes.

No	Mungbean genotype	Disease intensity		Resistant category
		42 dap	49 dap	
1	PsJ- S – 30	5.00	16.50	MR
2	PsJ- S – 31	17.50	26.25	MR
3	PsJ- S – 32	18.75	35.00	MS
4	PsJ- 6 - 90	15.00	30.00	MS
5	PsJ- 19 – 90	17.50	38.75	MS
6	PsJ- 21 - 90	16.25	30.00	MS
7	PsJ-B11-17-6	16.50	33.75	MS
8	PsJ- B11-5	22.50	38.75	MS
9	PsJ- B11-15	17.50	40.00	MS
10	Gelatik	17.50	37.50	MS
11	Perkutut	13.75	35.00	MS
12	Vima-1	41.25	48.75	MS

MR = moderately resistant, MS = moderately susceptible

Natural infection occurred on mungbean plants in a specific green house since all four wall sides were made from screen. The main purposes were to allow conidia passing through the screen and to reduce the heat because of green house effect. Conidia from outside moved into the greenhouse because of the wind. Table 2 shows powdery mildew disease intensities which varied from 2.0% to 22.6% and from 5.5% to 50.0% at 42 and 49 dap. The resistances of mungbean mutant genotypes to powdery mildew varied from resistant to moderately susceptible at 49 dap. PsJ-S-30 was categorized resistant and equal to the check 3, whereas PsJ-B11-5 was categorized moderately resistant and equal to Gelatik and Perikutut varieties (Table 2).

Gelatik and Perikutut varieties had high yield, whereas Vima-1 was superior on high production, spontaneous maturity, and pod position was on the top of canopy, as well as resistant to powdery mildew. Vima-1 has been released since 2008, and so far no superior varieties have been released. The next varieties released should be resistant to leaf spot disease. Of the nine genotypes tested, only one genotype, PsJ-30, was categorized moderately resistant to leaf spot disease. This genotype was promising for a new varietal development.

The resistance of mungbean against powdery mildew was controlled by a single vertical gene, therefore, the resistance was easily broken down. Therefore, the development of mungbean promising lines should be conducted continually to prevent the occurrence of new races of *E. polygoni*.

Table 2. Powdery mildew disease intensity on mungbean mutant genotypes.

No	Mungbean genotypes	Disease intensity		Resistant category
		42 dap	49 dap	
1	PsJ- S - 30	2.00	5.50	R
2	PsJ- S - 31	7.50	35.00	MS
3	PsJ- S - 32	20.00	48.75	MS
4	PsJ- 6 - 90	18.75	45.00	MS
5	PsJ- 19 - 90	15.50	50.00	MS
6	PsJ- 21 - 90	22.50	46.25	MS
7	PsJ-B11-17-6	15.00	45.25	MS
8	PsJ- B11-5	12.50	21.25	MR
9	PsJ- B11-15	17.50	41.25	MS
10	Gelatik	7.50	25.00	MR
11	Perikutut	8.75	18.75	MR
12	Vima-1	2.00	5.50	R

MR = moderately resistant, MS = moderately susceptible.

The high numbers of seeds per pod do not reflect the high seed weight, such as the line-9 which has the highest number of the seed per pod (31.50), however the seed weight (2.75 g) is lower than those of the PsJ-19-90 (3.04 g) as well as PsJ-S-32 (3.12 g) (Table 3).

Table 3. Seed number and seed weight of mungbean mutant genotypes

No	Mutant genotypes	Seed number/pod	Seed weight/4 plants
1	PsJ- S - 30	19.75	2.97
2	PsJ- S - 31	15.00	1.77
3	PsJ- S - 32	20.50	3.12
4	PsJ- 6 - 90	14.50	1.97
5	PsJ- 19 - 90	19.25	3.04
6	PsJ- 21 - 90	23.75	2.37
7	PsJ-B11-17-6	23.00	2.00
8	PsJ- B11-5	18.00	1.60
9	PsJ- B11-15	31.50	2.75
10	Gelatik	25.00	1.99
11	Perikutut	30.00	2.00
12	Vima-1	38.75	2.88

## CONCLUSION

Of the nine mutant mungbean genotypes, PsJ-S-30 was more resistant to powdery mildew and moderately resistant to leaf spot and had dry seed weight higher compared to that of check varieties (Gelatik, Perikutut, and Vima-1).

## References

- AVRDC. (2005). Powdery mildew and Cercospora leaf spot of mungbean. [http://www.avrdc.org/L.C/mungbean/producti on/disease.\(accessed 27-9-2005\).](http://www.avrdc.org/L.C/mungbean/producti on/disease.(accessed 27-9-2005).)
- Hardaningsih, S., Y. Baliadi dan N. Saleh. (1992). Penyakit kacang hijau dan Penanggulangannya. Dalam: Adisarwanto, T. dkk. (Penyunting). Kacang Hijau. Monograf Balittan Malang No. 9. Hal: 97-115
- Micke, A. (1983). Some consideration on the use of induced mutation for improving disease resistance of crop plants. In: Proc. Symp. Induced Mutant Disease Resistance Crop Plants. Int. at Energy Agr. Vienna. p.3-19.
- Nuryanto, B., Suparyono, dan Sudir. (1993). Periode kritis kacang hijau terhadap penyakit bercak daun (*Cercosporacanesens*). Hlm : 587 - 594. Dalam: Risalah Kongres dan Seminar Ilmiah Nasional XII PFI. Yogyakarta.



- Semangun, H. (2004). Penyakit-penyakit Tanaman Pangan di Indonesia. Gajah Mada University Press. Yogyakarta. 449 hal.
- Singh, D.P. (1986). Breeding for resistance to diseases and insect pests. Crop Pest Monograph. Springer-Verlag Berlin Heidelberg. 222 pp.
- Quebral, F.C. (1978). Powdery mildew and Cercospora leaf-spot of mungbean in the Philippines. In. The First International mungbean symposium August 16-19, 1977 at the UPLB. p: 147-148.
- Yang, C. Y. (1978). Mungbean disease and control. The First International mungbean symposium August 16-19, 1977 at the UPLB. p: 141-146.
- Prayogo, Y. dan Sri Hardaningsih. (1993). Inokulasi jamur embun tepung (*Erysiphe polygoni*) pada berbagai umur kacang hijau varietas No. 129. Dalam: Sumardiyono, Y. B. (Penyunting). Risalah Kongres dan Seminar Ilmiah Nasional XII PFI, Yogyakarta. Hal : 581 – 586.

## FUNCTION OF AGRICULTURE TECHNOLOGY ENVIRONMENT IN CARING FOR FOOD SECURITY SUPPORT IN SUBDISTRICT BELIK OF PEMALANG REGENCY

**Watemin and Sulistyani Budiningsih**

Agriculture Faculty of Muhammadiyah Purwokerto University  
watemyn@ump.ac.id

### **Abstract**

*This study aims to determine the use of agriculture technology by farmers in Subdistrict Belik. The study was conducted using a survey method with a sample of 60 farmers drawn randomly. Furthermore, the respondent interviews were conducted to determine the agriculture technology used is organic farming, semi-organic, and non-organic farming. The results of analysis show that the farmers have already raised awareness to preserving the environment by implementing organic farming. Obstacles encountered in applying agriculture technologies to preserve the environment is high pests and plant diseases, particularly on vegetable crops.*

**Keywords:** agribusiness, agriculture technology, environmental sustainability

### **BACKGROUND**

The dynamics of globalization that continues to grow, especially in the economic field caused by several things, namely: (1) Approval of the GATT Uruguay Round, signed in Marrakesh in April 1994 and the ratification of the World Trade Organization (WTO), (2) Agreement APEC countries in Bogor on November 15, 1994 to seek a free trade area in the Asia-Pacific region in 2020, (3) The formation of a free trade area efforts scope of ASEAN (AFTA) in 2003 were pursued through the Common Effective Preferential Tariff Scheme (CEPT), (Wibowo, 1996). Even globalization that is very real to be faced was the implementation of the ASEAN Single Community in 2015. All of these dynamics that in time will clearly involve the Indonesian economy on a more competitive global trade.

For the agriculture sector, the meaning of globalization may include the globalization of production and market globalization. In the globalization of production, each country or company can undertake activities anywhere prouksi most profitable for him, good for the entire component or the component parts of the product, or in the form of products such as primary, semi-

finished, and finished products. While globalization means integration of domestic markets with world markets. This gives the sense that the domestic market is part of the world market, and not wholly belong to us as one of the producers of agriculture products. Instead we are also challenged to be able to penetrate the markets of other countries are increasingly open. Thus become increasingly important for us to instill insight competitiveness and efficiency as a cornerstone in improving the role of agriculture in the national economy.

Agribusiness is a business unit of agro-based (agriculture) and are associated with agro products ranging from up-stream, farming activities (on-farm), agribusiness down-stream, and service trade, (Supari, 2001). Meanwhile, according Krisnamurthi and Fauzia (2003), the agricultural business can be referred to as agribusiness if the activity has been perceived as part of a broader business systems, and consists of:

1. Business inputs and agriculture inputs, such as fertilizers, pesticides, farm tools and machinery.
2. Business agriculture (farming) itself.
3. Agriculture processing business.
4. Business distribution and marketing of agriculture products and processed products.
5. Devices supporting various agriculture businesses, such as banking, research and development, and agricultural insurance.

An effort to develop agribusiness still many obstacles encountered, among others, business scale in a relatively small production systems, post-harvest problems, the relative lack of knowledge of farmers on market behavior, the quality and quantity of product, as well as the perceived capital formation is still very limited. Seeing the characteristics of agribusiness issues, the handling aspects of agribusiness, particularly at the level of local can be grouped into three terms, namely: (1) aspects related to human resource development, (2) institutional aspects, and (3) the creation aspects of the business and investment climate, (Wibowo, 1996).

The first step in handling problems of agribusiness is held agribusiness based resources.

To develop a resource-based agribusiness, especially natural resources will be driven by comparative advantage owned by the Indonesian region. This condition like that is owned by the Subdistrict Belik, that area is very suitable for use as a vegetable crop. However, vegetable production is very intensive with the use of excessive chemicals can damage soil fertility levels and even existing pesticide residue can interfere with human health. Therefore organic farming developed to overcome the problems of degradation of soil fertility. Based on these conditions, this study aims to determine the function of agriculture technology in preserving the environment in the Subdistrict Belik.

## METHODS

### Research Sites

This research was conducted in the Subdistrict Belik as one of the subdistricts that became centers Waliksarimadu Agropolitan Region. Of the 12 villages selected next 5 villages that became the center of activity in the Subdistrict Agropolitan Belik, the Village Belik, Gombong Village, Village Mendelem, Beluk Village, and the Village Bulakan.

### Source of Data

The data used in this study is primary data and secondary data. Primary data came from randomly selected respondents 60 people. Each selected village 12 respondents were taken farmers. While the secondary data derived from data documents related to problems studied.

### Methods of Data Collection

To obtain the necessary data in this study used the method of interviews with the respondents. As for secondary data extracted using the method of documentary.

### Methods of Data Analysis

Analysis of the data used in this research is to use quantitative and descriptive analysis, which describes the technology used by farmers in the Subdistrict Belik.

## RESULT AND DISCUSSION

In cultivation techniques of cultivated commodities, in general is influenced by the level of commercial and economic value of the commodity. Types of commodities that have commercial value and high economic value will generally be intensively cultivated by farmers. The following table shows the various technologies used by farmers in the Subdistrict Belik.

Table 1. Cultivation Technology Used Sample Farmers in Subdistrict Belik

Commodity	Cultivation technology (%)		
	Organic	Semi-Organic	Anorganic
1. Food Crops			
- Rice	-	57.14	42.86
- Corn	10.00	35.00	55.00
- Cassava	50.00	16.67	33.33
- Sweet potatoes	66.67	-	13.33
2. Vegetables			
- Chilli	7.69	23.08	69.23
- Cabbage	-	-	100.00
- Long beans	33.33	33.33	33.33
- Tomato	-	20.00	80.00
- Leaf Onions	-	20.00	80.00
- Kale	-	100.00	-
- Spinach	20.00	80.00	-
- Caisim	-	25.00	75.00
- Weloh	100.00	-	-
- Beans	-	100.00	-
- Eggplant	100.00	-	-
3. Fruits			
- Pineapple	66.67	13.33	-
- Banana	75.00	25.00	-
- Rambutan	100.00	-	-
- Mango	100.00	-	-
- Papaya	-	100.00	-
- Guava	-	100.00	-
- Longan	100.00	-	-
4. Plants Spices			
- Ginger	50.00	33.33	16.67
- Turmeric	50.00	33.33	16.67
- Clove	-	33.33	66.67
- Essential	-	33.33	66.67
- Curcuma xanthorrhiza	100.00	-	-
- Galingale crop	-	-	100.00

Source: Primary Data, 2013.

Based on Table 1. general technology in crop cultivation by farmers in Central District of Belik Agropolitan can be grouped into three categories of technology, the technology of organic farming, semi-organic farming, and non-organic farming. The definition of organic farming are applied by farmers in the Subdistrict Belik is that they say if they do not cultivation using fertilizers and chemical pesticides that can be described as a farming organic farming. If the cultivation of farmers still use chemical fertilizers or pesticides, the farm is still said to be a semi-organic farming. Whereas if the cultivation is still using chemical fertilizers and pesticides may be regarded as the agricultural non-organic farming.

Based on the understanding of the technology of agriculture cultivation by farmers in Subdistrict Belik, generally still following types of commodities are cultivated . In food crops for rice farmers in the Subdistrict Belik are not cultivated organically. But as much as 57.14 % have started cultivating semi-organic. This means that many farmers have started are concerned about the environmental aspects of sustainability in farming. With the start of agriculture towards implementing organic farming in addition to improvements in the quality of agriculture products that are free of pesticides also to preserve the environment. This is because the use of chemicals as fertilizers and pesticides continuously especially overused can degrade the quality of land and will eventually damage the environment. But to switch and use organic fertilizers and pesticides farmers have not dared to implement. This condition can be understood as rice crop is a crop that under no circumstances should remain, so that farmers will continue to maintain the results for household consumption. As for other crops that are not a staple food crops , such as maize and root crops, the farmers have started dare to fully implement organic farming.

For the types of commodities that are commercially cultivated and has a high economic value, generally non- farmers cultivate their crops organically. This condition occurs in vegetable crops that have economic and commercial value is high, such as chilli plants, tomato, scallion, cabbage, and caisim. These plants are generally cultivated by farmers in terms of maintenance intensive, ranging from planting to harvest. Intensification of plant maintenance is carried out by farmers to obtain maximum results, considering this vegetable has a lot of demand in the market. Besides these types of vegetables are also generally have high levels of pests and diseases is high

enough to require intensive care. It is therefore generally farmers use chemical pesticides to control pests and plant diseases to avoid the risk of crop failure. In addition to increase production yields obtained by the farmers will generally add chemical fertilizer production plant vegetables so that they earn a maximum income.

In fruit crop plants that are interrupted in the yard or the garden, farmers cultivate them organically. In this case the farmer does not provide additional fertilizers or chemicals to control pests and diseases in plants. Plant maintenance is generally performed by a farmer just by clearing grass around the plant. Types of fruit trees are generally grown organically is a plant rambutan, mango, and longan. As for the fruit trees that characterizes the Subdistrict Belik, namely pineapple and banana farmers generally have started doing intensive cultivation, although still not up to the stage of commercial crops such as vegetables. However, the pineapple and banana crops , farmers in Subdistrict Belik are already adding chemical fertilizers to increase crop production they would earn. To plant fruit papaya and guava is a fruit crop cultivated by farmers in Subdistrict of Belik. For these plants are generally farmers add fertilizers in cultivation, because these types of fruit trees is actually commercially cultivated by farmers .

For medicinal plants that have high economic value crops such as cloves and volatile, farmers generally have cultivated intensively. To obtain maximum results generally maintain crop farmers by providing chemical fertilizers and to combat pests and diseases in plants using chemical pesticides. While the ginger and turmeric crop farmers have started to cultivate semi-organic along with the increase of this type of commodity for industrial needs.

In general, the purpose of farmers applying organic farming is that in addition to getting quality products that are free of pesticides, as well as to preserve the environment. This suggests that the actual level of awareness of farmers are already there to implement environmentally sound farming activities, it's just that these activities are high, there are still barriers to pests and disease so that the risk of crop failure is still very high when farmers do not use chemical pesticides. Therefore, to maintain production and to obtain better production results in the application of organic farming the farmers in the Subdistrict Belik not start using chemical fertilizers and some also use organic fertilizers. Meanwhile, to cope with pests and diseases farmers

try some natural pesticides that can be used to reduce the level of pests and diseases of plants.

## CONCLUSION

Based on the above description it can be concluded that:

1. Already raised awareness for protecting the environment with organic farming systems at the farm level in the Subdistrict Belik.
2. Agriculture technology used for staple crops, not using pure organic farming because farmers still fear a decline, and even the loss of production due to pests and plant diseases.
3. For vegetable crops that have high economic value of agriculture technology is used still non-organic farming because of the risk of loss that may arise.
4. In fruit trees and medicinal plants cultivation system has not been carried out intensively used agriculture technology has been using organic farming.

## References

- Baharsjah , B. 1993. *Horticulture as a Source of New Growth of Agriculture Sector* . In Aziz , M.A. : *Tropical Fruits Agro-industry : Development Prospects at PJPT II*. Centre for Information and Development Studies (CIDES) Jakarta, Center for Agriculture Development (PPA) Jakarta, Science and Culture Journal Ulumul Qur'an (UQ) Jakarta.
- BPP Subdistrict of Belik. 2004. *Programa Agricultural Extension* 2000/2001. BPP Subdistrict of Belik.
- Krisnamurthi , B. and L. Fauzia . 2003. *Steps to Starting a Successful Agribusiness*. Penebar Swadaya, Jakarta.
- Moerdiyanto, E. and Darmadi. 2001. *Agribusiness with Integrated Approach*. Journal of Economic Dynamics. Vol.2 No.2, Department of Social Economics of Agriculture, Agriculture Faculty, University of National Development " Veteran ", Yogyakarta .
- Syahza , A. 2004. Palm Oil and Welfare in Rural Farmers. *Perspectives*, Vol 9, No. 2, December 2004 , pp. 95-103. Ecocomic Faculty of University Sebelas Maret, Surakarta.
- Supari. 2001. *Production and Operations Management Horticulture Agribusiness*. PT . Elex Media Komputindo, Jakarta.
- Wibowo, R. 1996. *Strategic Environmental 21st Century and Implications for Agriculture Sector*. Seminar Papers : *Cultural Development and Agriculture Society Ethics to Face 21<sup>st</sup> Century*. Agriculture Faculty of Gadjah Mada University, Yogyakarta.

## EFFECT OF RICE BRAN AND ANORGANIC FERTILIZER DOSAGES ON YIELD OF WHITE OYSTER MUSHROOM (*Pleurotus ostreatus*)

Agus Mulyadi Purnawanto, Oetami Dwi Hajoeningtijas, Pujiati Utami

Faculty of Agriculture, University of Muhammadiyah Purwokerto

Jl. Raya Dukuhwaluh, Purwokerto, Indonesia 53182

Email: agoesmp@gmail.com

### Abstract

*This study aimed to determine the effect of rice bran and SP36 fertilizer doses on yield of white oyster mushroom. This research was conducted at Dukuhwaluh village, Kembaran Sub District, Banyumas district in March to November 2012. The study is based on randomized completely block design and repeated five times. The study consisted of two factors, the first factor was dose of rice bran (B), consisting of three levels, namely, B1: 7.5 kg rice bran, B2: 15 kg rice bran and B3: 22.5 kg rice bran /100 kg of sawdust. The second factor was dose of SP36 fertilizer (P), consists of four levels, namely, P1: 0.5 kg SP36, P2: 1.5 kg SP36 and P3: 2.5 kg SP36/100 kg of sawdust.*

*The results showed that application of 25 kg of bekatul/100 kg of sawdust (B3) can speed up and increase the harvest period, increasing the number of fruiting bodies, diameter of fruit bodies and total fresh weight of fruit bodies. While application of SP36 fertilizer and interactions between giving rice bran and SP36, largely not significant for all variables.*

**Keywords:** White oyster mushroom, *P. ostreatus*, rice bran, anorganic fertilizers, SP36

### BACKGROUND

Fungi are organisms lacking chlorophyll that can not provide their own food by photosynthesis as the chlorophyll in plants. Therefore, fungi take nutrients from other organisms for their needs. In general, fungi live on the rest of the dead creatures, such as the piles of garbage, sawdust, or on decaying logs (Suriawiria, 2006).

The growing medium is one important aspect that determines the success rate of mushroom cultivation. Media white oyster mushroom is used to contain the nutrients needed for growth and the production of which is lignin, carbohydrates (glucose and cellulose), protein, nitrogen, fiber, and vitamins. These compounds can be obtained from wood sawdust, rice bran, straw, husks, and rice flour (Cahyana, 2004). The growth of fungal mycelium depending on the substrate, nutrients and

environmental conditions of growth (Hassan, Medany and Hussein, 2010).

Poppe (2000) states that oyster mushrooms can be grown on several substrates. Plant waste such as wheat straw, rice straw, banana leaves, corn cobs, sawdust and pea straw can be used as a substrate for oyster mushrooms. In the United States, oyster mushrooms produced in the skin substrate cottonseed, wheat straw, sawdust, or a combination among these materials (Royse *et al.*, 2004)

The addition of rice bran in the oyster mushroom growing medium serves to enhance the nutritional plant media as a source of carbohydrates, carbon (C) and nitrogen (N). Rice bran as a source of N and thiamin (Vitamin B1) function in the formation and development of white oyster mushroom fruit body. In addition, for the life and development fungus also requires a source of nutrients or food in the form of chemical elements, such as nitrogen, phosphorus, sulfur, potassium and carbon. These elements are available in wood tissue that is the primary oyster mushroom growing medium creation, it's just a few. Therefore, the necessary additions from outside, for example in the form of fertilizer that is used as a mixture of substrate mushroom growing medium creation (Suriawiria, 2006).

Most nutrients required for the growth of the fungus is an element of P and K. P element required for the formation of plant organs for reproduction, other than P also serves to encourage the growth of plant roots. Element K is generally instrumental in shaping and transport form of carbohydrates, a catalyst in the formation of proteins, raising the meristem tissue growth, the plants become more contained and dense, improve fruit quality, and increase the plants more resistant to pests and diseases (Rosmarkam and Yuwono, 2002).

Based on the description above, it is important to do research on the effect of variations in the rice bran and SP36 fertilizer dose on yield of white oyster mushrooms are grown on sawdust substrates.

## METHOD

The experiment was conducted at Dukuhwaluh village, Kembaran Sub District, Banyumas district in March to November 2012. The materials used in this study include albasia wood sawdust, rice bran, tapioca starch, gypsum, limestone,  $\text{CaCO}_3$ , SP36 fertilizer, spirits, and white oyster mushroom seeds. The equipment used include a plastic measures 17 cm x 35 cm x 0.4 mm, rubber bands, PVC ring measures 2 inches, paper, sacks, scale, press equipment, sterilizer, filter wire, bamboo rack, shack, sprayer, hygrometers, thermometer, Bunsen lamp, spatulas and knives.

The study is based on randomized completely block design and each treatment was repeated five times. The study consisted of two factors. First factor, the dose of rice bran (B), consisting of three levels, B1 = 7.5 kg; B2 = 15 kg and B3 = 22.5 kg per 100 kg of sawdust. The second factor, the dose of SP36 fertilizer (P), consists of four levels, P1 = 0.5 kg; P2 = 1.5 kg and P3 = 2.5 kg of fertilizer SP36 per 100 kg of sawdust

### *Implementation of the experiment*

Initially set up shacks of bamboo fitted shelves in it, to the incubation (plastic bags that have been filled with growing media and was inoculated with white oyster mushroom seeds). All equipment will be cleaned before use with spirits. Sterilization and a white oyster mushroom cultivation room also cleaned.

Sawdust mixed with other ingredients including rice bran and SP36 (which has been dissolved in water first for one week), according to treatment. All the ingredients stir until evenly while adding water to taste SP36 fertilizer solution until sufficient moisture is obtained if the fist is formed clots but still easily destroyed again. The materials used (other than rice bran and SP36) is 100 kg of sawdust, 2 kg of tapioca flour, 1.5 kg of Gypsum, 3 kg of limestone and 1 kg of  $\text{CaCO}_3$ . After the mixture was filtered medium sieve with holes of 1 cm<sup>2</sup> for separating sawdust rough.

After mixing and sifting, the media is inserted into a plastic bag, and then compacted using a press. Each plastic bag containing approximately one kilogram of material a mixture of sawdust and other materials with the composition according to the treatment. Then the media were left in the open for three days with a plastic mouth position is at the bottom (for composting). During this process the temperature is maintained around 40°C – 50°C. If the temperature increases so do the rotational position of the media to achieve its original temperature.

Plastic bags (baglog) which already contains media then inserted into the sterilizer. Sterilization conducted for 10-15 hours using hot steam. Sterilization temperatures up to 110°C and maintained for 2-3 hours. Media that has been sterilized and cooled outside of the sterilizer.

Inoculation is done by entering mushroom seeds into the medium using a spatula. Each media stuffed mushroom seeds by about 1/2 tablespoon. The media that had been inoculated then given ring PVC and covered with paper and tied with a rubber band.

Planting medium that has been inoculated placed on bamboo racks that have been provided in the shacks. Media placement is done by tilting, and prepared in accordance with the plan of experiment. Incubation is carried out until all the white media evenly (mycelium growing perfectly and evenly) which is about 30-50 days after incubation.

After media overgrown mycelium and white uniform, appeared pinhead of mushroom. Pinhead of mushroom is allowed to achieve optimal growth (before the edge of the hood torn). After the mushrooms are harvested, made opening the cover media to assist in the re-growth of the oyster mushroom, by opening and removing the existing PVC rings on baglog.

Maintenance includes examining incubation space in terms of humidity, temperature, cleanliness and protection against rodents, insects, etc.. If the temperature exceeds 30°C and humidity less than 80%, spraying water using a sprayer.

Harvesting is done after the growth of the fungus reaches the optimal level, which is quite large but not yet in full bloom (before the edge of the hood torn). Harvesting is done by removing all the white oyster mushroom grove that exist in one baglog.

Parameters observed are: the first time pinhead appeared, the number of fruit body, the diameter of fruit body and the total fresh weight of fruit body. The data were analyzed by analysis of variance (F test at level 5%) and if there is significant effect of the treatment on parameters then the data were further analyzed using LSD 5% level.

## RESULTS AND DISCUSSION

### *The first time pinhead appeared*

There is a significant effect on the interaction between the dose of rice bran with SP36 fertilizer in the planting medium to grow oyster planting the current variable pinheads appear, at first and second harvest. Data in Table 1 shows that the fastest

pinheads appeared on the first harvest period is 34 days after inoculation, occurred in treatment B2 P1 and B2 P2 (giving as much as 15 kg of rice bran combined with the addition of 0.5 kg and 1.5 kg of SP36/100 kg of sawdust). While the longest was 41 days after inoculation, which occurred in treatment B2 P3 (giving as much as 15 kg of rice bran combined with the addition of 2.5 kg of SP36) or the treatment of B3 P1 (giving as much as 22.5 kg of rice bran combined with the addition 0.5 kg of SP36).

The speed pinheads appear in the first period harvest, does not guarantee faster the appearance of a pinhead on the third harvest period and beyond. In the period from the third to the last harvest, in fact the average of pinhead appeared fastest advent

occurs in treatment B3 P2 (given 22.5 kg of rice bran and 1.5 kg of SP36) or treatment B3 P3 (given 22.5 kg of rice bran and SP36 as much as 2.5 kg).

The giving of as much as 22.5 kg of rice bran combined with the giving of as much as 0.5 kg; 1.5 and 2.5 kg of SP36 (B3P1, B3P2 and B3P3) can increase the number of oyster mushroom harvest period, which reached six harvest periods (Table 1). This happens because the rice bran can increase the availability of carbon which is the main source for mushroom growing medium as well as serve to build miselin and enzymes needed for oyster mushroom cultivation. The content of this enzyme causes the production of oyster mushrooms can last for quite a long time (Sutarja, 2010).

Table 1. Average first time pinheads appeared (days after inoculation) in combination treatment of rice bran and SP36 different providing

Treatment	harvest period to ...					
	1	2	3	4	5	6
B1 P1	39 bc	64 c	83	111	118	-
B1 P2	38 bc	57 ab	82	106	117	-
B1 P3	37 ab	56 a	78	103	114	-
B2 P1	34 a	56 a	78	102	116	-
B2 P2	34 a	56 a	79	101	118	-
B2 P3	41 c	62 bc	84	106	121	-
B3 P1	41 c	60 abc	76	94	110	122
B3 P2	39 bc	57 ab	71	86	104	119
B3 P3	40 bc	59 abc	75	90th	104	118
LSD 5%	3.1	5.6	ns	ns	ns	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Table 2 shows that the application of rice bran 22.5 kg (B3), it affects the appearance of pinhead appeared in the first period when compared to application of rice bran by 7.5 kg and 15 kg (B1 and B2). But for the next harvest period, giving it more and more rice bran to accelerate the advent of pinhead appear. Even with the growing provision of bran, yields also increased.

The more rapid pinhead appear with the increasing number of rice bran given, according Mufarrihah (2009) because rice bran has the function to improve the nutrition of growing media,

as a source of carbohydrates, carbon (C) and nitrogen (N). Rice bran as well as a source of Nitrogen and thiamin (Vitamin B1), which functions in the formation and development of white oyster mushroom fruit body.

Moonmoon *et al.* (2011) reported that the growth and yield of shiitake mushroom (*Lentinus edodes*) on sawdust significantly influenced by differences in the rates of wheat bran, rice bran and corn flour. Achieved the highest rate of growth of mycelium on providing as much as 20% rice bran.



Table 2. Average first time pinheads appeared (days after inoculation) on rice bran different application treatment

Treatment	harvest period to ...					
	1	2	3	4	5	6
Bran:						
B1 = 7.5 kg	38 a	59	83 b	107 b	116 b	-
B2 = 15 kg	37 a	58	82 ab	103 ab	118 b	-
B3 = 22.5 kg	40 b	58	78 a	90 a	106 a	120
LSD 5%	1.8	ns	4.8	4.4	3.9	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Variations SP36 application in the oyster mushroom growing media exert a significant effect on the advent of the current pinhead first, second and fourth harvest period (Table 3). At the advent of the fastest oyster mushroom caps on average occurs in granting SP36, 1.5 kg (P2), but usage of 2.5 kg of SP36 (P3) over the length of time it has pinhead appear. Giving a P element in the oyster

mushroom growing medium can accelerate the advent of pinhead, but the increase in giving P element that is not accompanied by an increase of N causes an interruption in the availability of protein in the medium so that the mycelium growth is slower, may eventually lead to the formation of a mushroom cap longer (Herlina, Koesriharti and Bramanti, 2012).

Table 3. Average first time pinheads appeared (days after inoculation) on providing SP36 different treatment

Treatment	harvest period to ...				
	1	2	3	4	5
SP36:					
P1 = 0.5 kg	38 ab	60 b	79	103 b	114
P2 = 1.5 kg	37 a	57 a	77	98 a	112
P3 = 2.5 kg	39 b	59 ab	79	100 ab	113
LSD 5%	1.8	3.2	ns	4.4	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

#### Number of fruit body

The general treatment of the interaction between variations in the provision of rice bran with variations SP36 fertilizer in the planting oyster growing medium did not significantly affect to number of fruit body, except the third harvest period. Number of fruit body formed decreased with increasing duration of the harvest period. Number of fruit body most occurred during the first harvest (Table 4).

Decrease the number of fruit body formed by nutrients in the growth medium that continues to decline in line with the length of growing oyster mushrooms. However, with the addition of rice bran treatment variations apparently affect the number of fruit body. Giving rice bran 22.5 kg per 100 kg of sawdust media (B3) can produce the highest number of fruit body on all of the harvest period, when compared with rice bran as much as 7.5 kg (B1) and 15 kg (B2). Even the giving of

treatment as much as 22.5 kg of rice bran can increase the number of the harvest period (Table 5). It is thought by giving rice bran that the more the nutrients that exist in oyster mushroom growing medium is also increasing, so it can support a lot of secondary mycelium formation and finally to form a pinhead that much anyway. As Mufarrihah study (2009), awarding rice bran that more and more, up to 20% of medium, can produce a number of fruit bodies more and more. Similarly, according to Purba (2004) that the application of vitamin B complex on the media without any rice bran is not able to support the formation of fruiting bodies. It is also in line with the results of Rossi *et al.* (2003) who reported that the addition of rice bran in the substrate (growing medium) can increase the number of fruiting bodies shiitake mushrooms (*L. edodes*), in particular the addition of as much as 25% and 30%.

Table 4. Average number of fruit body in in combination treatment of rice bran and SP36 different providing

Treatment	harvest period to ...					
	1	2	3	4	5	6
B1 P1	7	7	5 ab	3	3	-
B1 P2	9	7	6 ab	3	3	-
B1 P3	8	7	4 a	3	2	-
B2 P1	8	7	5 ab	3	3	-
B2 P2	10	6	4 a	4	2	-
B2 P3	11	8	7 bc	4	3	-
B3 P1	11	9	6 ab	5	3	2
B3 P2	11	9	7 bc	6	4	3
B3 P3	10	9	8 c	6	4	3
LSD 5%	ns	ns	2.9	ns	ns	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Table 5. Average number of fruit body on rice bran different application treatment

Treatment	harvest period to ...					
	1	2	3	4	5	6
Bran:						
B1 = 7.5 kg	8 a	7 a	5 a	3 a	2 a	-
B2 = 15 kg	10 ab	7 a	5 a	4 b	2 a	-
B3 = 22.5 kg	11 b	9 b	7 b	6 c	4 b	3
LSD 5%	2.3	1.2	1.7	0.9	0.6	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Providing SP36 in  
theory term mushroom growing media in general does  
not give significant effect on the current the advent  
of the pinhead (Table 6). But there is a tendency by

providing SP36 of 2.5 kg, the number of fruit body  
also produced more, although not significantly  
different from the giving of SP36 as much as 0.5  
kg.

Table 6. Average of number of fruit body on SP36 different provision treatment

Treatment	harvest period to ...				
	1	2	3	4	5
SP36:					
P1 = 0.5 kg	9	8	5 a	4	3
P2 = 1.5 kg	10	7	6 ab	4	3
P3 = 2.5 kg	10	8	7 b	5	3
LSD 5%	ns	ns	1.7	ns	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

### **Diameter of fruit body**

The interaction between variations in the  
providing of rice bran with SP36 fertilizer variation  
in oyster mushroom growing medium significantly  
affect to the diameter of fruit body on the first and  
third harvest period (Table 7). Diameter of fruit  
body correlated with the number of fruit body, the  
more of the number of fruit body, the smaller the

diameter of the fruit body. This is made clear by  
the results of the Tutik (2005) which states that the  
fungus grows forming clumps, which when in an  
amount covering that forms clumps much it will  
affect the diameter of the pinhead, the pinhead  
smaller. Rohmah (2005) also states that if the  
number of fruit bodies are growing less and less,

then the diameter mushroom shaped pinhead bigger/wider.

Diameter of fruit body formed decreased with increasing duration of the harvest period. Diameter of fruit body occurs in the first harvest period. In the period from the first harvest, the

biggest diameter of pinhead, 8.3 cm, occurred in B3P3 treatment (22.5 kg rice bran and 2.5 kg of SP36) but not significantly different with some other treatment, including treatment B1P1 (bran 7.5 kg of rice bran and 0.5 kg SP36)

Table 7. Average diameter of fruit body in combination treatment of rice bran and SP36 different providing

Treatment	harvest period to ...					
	1	2	3	4	5	6
B1 P1	7.6 ab	7.0	6.9 abc	5.9	5.8	-
B1 P2	7.5 ab	6.9	6.3 a	5.7	6.8	-
B1 P3	8.0 ab	7.5	6.9 abc	6.2	6.2	-
B2 P1	7.9 ab	7.2	6.5 ab	5.9	5.6	-
B2 P2	8.1 b	7.6	6.8 abc	6.4	5.5	-
B2 P3	7.2 a	7.6	7.0 bc	6.6	5.8	-
B3 P1	8.0 ab	7.6	7.3 c	6.3	5.9	4.8
B3 P2	7.5 ab	7.7	7.0 bc	6.3	5.6	5.1
B3 P3	8.3 b	7.6	6.8 abc	6.3	5.9	5.6
LSD 5%	0.7	ns	0.6	ns	ns	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Table 8. Average diameter of fruit body on rice bran different application treatment

Treatment	harvest period to ...					
	1	2	3	4	5	6
Bran:						
B1 = 7.5 kg	7.7	7.2 a	6.7 a	6.0 a	5.2 a	-
B2 = 15 kg	7.7	7.5 ab	6.8 ab	6.3 b	5.6 ab	-
B3 = 22.5 kg	8.0	7.6 b	7.1 b	6.3 b	5.8 b	5.2
LSD 5%	ns	0.3	0.3	0.2	0.4	ns

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.  
ns = not significant

Giving of rice bran significantly affect to diameter of fruit body in nearly all the harvest period (Table 8), while the providing of SP36 does not exert a significant effect on the diameter of the fruit body. Giving rice bran 22.5 kg (B3) gives the diameter of the large fruit body, but not significantly different from the provision of as much as 15 kg of rice bran (B2). Despite the greater number will reduce the diameter of fruit body, but with the availability of good nutrition as the B3 treatment, the growth of pinhead will also be better.

#### **Fresh weight of fruit body**

The interaction between variations of rice bran with variations of SP36 fertilizer treatment did not significantly affect to the fresh weight of fruit body at each harvest period, except in the third harvest period. However, for total fresh weight of fruit

bodies, interactions between variations of rice bran with variations SP36 fertilizer providing, gave significant effect (Table 9).

Giving rice bran by 7.5 kg and 0.5 kg SP36 (B1P1) produces fruit bodies with fresh weight low, which is 218 grams. While the fresh weight of fruit bodies highest achieved by 22.5 kg of rice bran combined with SP36 as much as 0.5 kg (B3P3) and did not differ significantly with treatment B3P1 (22.5 kg rice bran and 0.5 kg SP36) and treatment B3P2 (22.5 kg rice bran and 1.5 kg SP36).

The addition of rice bran to improve the nutrition of growing media as a source of carbohydrates, carbon (C) and nitrogen (N). Rice bran as a source of N and thiamin (Vitamin B1) function in the formation and development of white oyster mushroom fruiting bodies (Suriawirja, 2006).

Table 9. Average fresh weight of fruit body in combination treatment of rice bran and SP36 different providing

Treatment	harvest period to ...						Total
	1	2	3	4	5	6	
B1 P1	88	75	52 ab	34	21	-	218 a
B1 P2	95	81	47 a	28	23	-	227 ab
B1 P3	97	84	45 a	31	23	-	235 bc
B2 P1	103	87	45 a	28	22	-	240 bc
B2 P2	103	92	44 a	31	21	-	247 c
B2 P3	108	90	65 abc	38	26	-	262 d
B3 P1	123	102	62 abc	38	28	13	304 e
B3 P2	115	101	73 bc	45	26	21	308 e
B3 P3	119	96	76 c	47	28	22	312 e
LSD 5%	ns	ns	23.05	ns	ns	ns	13.5

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.

ns = not significant

In addition, according Suriawiria (2006), for the life and development also requires yeast nutrient or food source in the form of chemical elements, such as nitrogen, phosphorus, sulfur, potassium and carbon. These elements are available in wood tissue that is the primary creation mushroom growing medium, it's just a few. Therefore, the necessary additions from outside, for example in the form of fertilizer that is used as a mixture of substrate creation plant or fungus growing media.

The addition of rice bran to 22.5 kg (B3) can increase the production of fresh weight of fruit

body (Table 10). This is due to fungal growth requires many nutrients, good nutrition is derived from the main medium of sawdust or other media material such as rice bran. As the opinion Cahyana *et al.* (2004), nutrition plays an important role in the process of oyster mushroom cultivation. Nutritional raw materials or ingredients should be added according to the needs of oyster mushrooms. The raw materials can be used as a medium of dried sticks, a mixture of sawdust and straw or reeds. Besides the raw material should be added some additional ingredients such as rice bran as a source of carbohydrates, fats and proteins.

Table 10. Average fresh weight of fruit body on rice bran different application treatment

Treatment	harvest period to ...						Total
	1	2	3	4	5	6	
Bran:							
B1 = 7.5 kg	93 a	80 a	48 a	31 a	22 a	-	274 a
B2 = 15 kg	105 b	90 a	51 a	32 a	23 a	-	301 b
B3 = 22.5 kg	119 c	100 b	70 b	43 b	27 b	19	378 c
LSD 5%	10.5	10.6	13.3	4.8	3.6	ns	22.4

Notes: Numbers followed by the same letter in the same column, are not significantly different at 5% LSD.

ns = not significant

The results Alam *et al.* (2010) showed that the addition of corn meal and 30% rice bran on the rice straw substrate significantly affect yield of milk white mushrooms (*Calocybe indica*). The condition is also consistent with the results of Eswaran and Thomas (2003) in the same mold.

## CONCLUSION

The providing of 25 kg of bekatul /100 kg of sawdust (B3) can speedup and increase the harvest period, increasing the number of fruiting bodies, the diameter of fruit bodies and total fresh weight of

fruit bodies. While giving SP36 and the interaction between the giving of rice bran and the SP36 in general no significant effect on all variables.

## References

Alam, N., R. Amin, A. Khair and Tae Soo Lee. 2010. Influence of Different Supplements on the Commercial Cultivation of Milky White Mushroom. *Mycobiology* 38 (3): 184-188

- Cahyana. 2004. *Jamur Tiram*. (Oyster Mushroom). Penebar Swadaya. Jakarta
- Cahyana, Muchroji dan M.Bachrun. 2004. *Jamur Tiram*. (Oyster Mushroom). Penebar Swadaya. Jakarta
- Eswaran A and Thomas S. 2003. Effect of various substrates and additives on the yield of sporophores *Calocybe indica* and *Pleurotus* species. *Indian J Mush* 2003; 21:8-10.
- Hassan, F.R.H., G.M.Medany and S.D.A.Hussein. 2010. Cultivation of the King Oyster Mushroom (*Pleurotus eryngii*) in Egypt. *Australian Journal of Basic and Applied Sciences*, 4 (1): 99-105
- Herlina, N., Koesriharti dan L. Bramanti. 2012. The Effect of Anorganic Fertilizers Application on Yield of White Oyster Mushroom (*Pleurotus florida*). *Advances in Natural and Applied Sciences*, 6 (6): 819-822
- Moonmoon, M., N.J.Shelly, Md.A.Khan, Md.N.Uddin, K.Hossain, M.Tania and S.Ahmed. 2011. Effects of different levels of wheat bran, rice bran and maize powder supplementation with saw dust on the production of shiitake mushroom (*Lentinus edodes* (Berk.) Singer). *Saudi Journal of Biological Sciences* (2011) 18, 323-328
- Mufarrihah, L. 2009. *Pengaruh Penambahan Bekatul dan Ampas Tahu terhadap Pertumbuhan dan Produksi Jamur Tiram Putih (Pleurotus ostreatus)*. (Effect of addition of bran and Pulp Know the Growth and Production of Oyster Mushroom White (*Pleurotus ostreatus*). Undergraduate Thesis. Faculty of Science and Technology. State Islamic University of Malang .
- Poppe, J. 2000. Use of Agricultural waste materials in the cultivation of mushrooms, pp 3-23. In: Science and Cultivation of Edible Fungi. van Griensven L. J. L. D (ed.). *Proceedings of the 15th International Congress on the Science and Cultivation of Edible Fungi*, Maastricht, Netherlands 15th- 9th May, 2000
- Purba, H.P. 2004. *Pertumbuhan jamur tiram putih (Pleurotus ostreatus) pada media dasar yang komponen berkatulnya telah disubstitusi dengan vitamin B kompleks*. (Growth of white oyster mushroom (*Pleurotus ostreatus*) on the basis media that rice bran component been substituted with B complex vitamin. Undergraduate Thesis. University of Diponegoro.
- Rohmah, A.N. 2005. *Pengaruh Penambahan Blotong dan Lama Pengomposan terhadap Pertumbuhan dan Produksi Jamur Tiram Putih*. (Effect of addition of filter cake and Old Composting on Growth and Production of White Oyster Mushroom). Undergraduate Thesis. Faculty of Science and Technology. State Islamic University of Malang
- Rosmarkam, A. and N.W.Yuwono. 2002. *Ilmu Kesuburan Tanah*. (Soil Fertility Studies). Kanisius. Yogyakarta.
- Rossi, I.H., Monteiro, A.C., Machado, J.O., Andrioli, J.L., Barbosa, J.C. 2003. Shiitake (*Lentinula edodes*) production on a sterilized begasse substrate enriched with rice bran and sugarcane molasses. *Braz. J. Microbiol.* 34, 66-71.
- Royse, D.J., T.W. Rhodes, Ohga S. and J.E. Sanchez. 2004. Yield, mushroom size and time to production of *Pleurotus cornucopiae* (oyster mushroom) grown on switch grass substrate spawned and supplemented at various rates. *Bioresource Technology* 19: 85-91.
- Suriawiria. 2006. *Budidaya Jamur Tiram*. (Oyster Mushroom Cultivation). Kanisius. Yogyakarta
- Sutarja, 2010. *Produksi jamur tiram (Pleurotus ostreatus) pada media campuran serbuk gergaji dengan berbagai komposisi tepung jagung dan bekatul*. (Production of oyster mushroom (*Pleurotus ostreatus*) on sawdust mixed media with different compositions corn flour and rice bran). Thesis. Sebelas Maret University. Surakarta.
- Tutik, H.P.T. 2005. *Pengaruh Penambahan Kompos Azolla Terhadap Pertumbuhan Dan Hasil Jamur Tiram Merah (Pleurotus flabellatus)*. (Effect of addition of Azolla compost on growth and yield of Red Oyster Mushroom (*Pleurotus flabellatus*). Undergraduate Thesis. Department of Agronomy. Faculty of Agriculture, University of Muhammadiyah Malang.

## UTILIZATION OF WASTE OIL PALM AS A TOTAL MIXED RATION SILAGE WITH LOCAL RESOURCES BASED TO ACHIEVED FOOD SECURITY IN AN ANIMAL PROTEIN SOURCES

Agung Irawan<sup>1,2)</sup>, Mohammad Sholikin<sup>1)</sup>

<sup>1)</sup> Students of Department of Animal Science, University of Muhammadiyah Malang  
Jl. Raya Tlogomas No. 246 Malang, East Java, Indonesia

<sup>2)</sup> E-mail: agung\_husbandry@yahoo.com

### Abstract

*Recently, the development of the livestock sector is not only oriented to compliance issues of animal origin food healthy and salubrious (production aspects), but also closely related to the health of the environment (eco-friendly). Indonesia is the largest palm oil producer in the world. This paper aims to explain the potential of oil palm waste generated as a ruminant feed is a total mixed ration silage so as to improve the quality of animal production to achieved food security in animal protein sources. Results of the analysis showed that palm oil waste have great potential to address feed scarcity and bad quality feed in Indonesia. Each year, the Indonesian oil palm plantations can produce each leaf waste without a stick of 3557.4 million tons, the midrib of 8867.32 million tons, empty fruit bunches of 18307.76 million tons, fiber of juice 14495.99 million tons, mud of palm oil amounted to 6120.61 million tons, and palm oil cake of 2779.2 million tons. In addition, the use of TMR Silage will also have a positive impact on the environment and livestock, among others increasing ruminant productivity, improve food safety, and reduce the level of methane gas production. It was concluded that the use of palm oil waste to overcome the scarcity of feed and improve feed quality and reducing the ruminants methane gas emissions. Finally, this concept could be increasing the productivity of ruminant in Indonesia to support animal products sustainability.*

**Keywords:** Waste Palm Oil, TMR Silage, Local Resources, Food Security

### INTRODUCTION

Recently, the development of the livestock sector is not only oriented to compliance issues of animal origin food healthy and salubrious (production aspects), but also closely related to the health of the environment (eco-friendly). Environmental pollution is a negative

impact that many common due to poor governance farms. The low quality of feed causes methane production in the rumen (CH<sub>4</sub>) and in line with the increases will negatively affect the productivity of ruminants. The higher crude fiber a feed, the lower and the higher digestibility methane emissions generated. Mitigation efforts in the agricultural and livestock sector is very important because this sector is contributing to the emergence of greenhouse gas emissions (GHG).

Around 15% of global warming contributed to the production of methane. Coefficients capture the radiation emitted by the earth CH<sub>4</sub> twenty-five times more effective than CO<sub>2</sub> (Reay et al. 2010). Reported by Thalib (2008), that about 50 percent of methane emissions from human activity results from agricultural activities. Of these, the livestock sector contributes methane gas is 12% globally and nationally is 1.2% (Dourmard et al. 2008).

Livestock statistics in 2012 mentions that the export-import balance farms in 2010-2011 was in deficit by an increase in imports of 14.82 million head of beef cattle (increased 3.77 %) and 0.59 million head of dairy cattle (increased 22.27 %). In addition, imports of raw material feed for ruminants is still high which causes a lack of independence of feed, especially in the dry season. In Indonesia, the facts about the show than the quantity of feed that do not meet the requirement, the quality of feed is also very low.

Indonesia is the largest palm oil producer in the world. Indonesia accounted for 44 % of the palm oil in the world. Automatically, the waste produced from oil palm plantations would be enormous potential. However, the use and improvement of the effluent quality is not optimally.

Total Mixed Ration or complete feed is a mixture of animal feed consisting of several feedstuffs such as forages, concentrates, protein supplements, minerals, and vitamins are mixed together to obtain a good nutritional formulations. Continuous availability of food throughout the year,

cheap, and high nutritional value can be done through the utilization of technology development Total Mixed Ration (TMR) Silage local use of lactic acid bacteria by using palm oil waste sebagai main ingredient. The concept of integration of cattle with oil palm plantations is nothing new, in Malaysia this system has been running since 2002. However, so far the system is running only limited integration of cattle raising activities in the area of oil palm plantations. Utilization of waste palm oil plantations have led to an increase in the quality of the feed itself.

TMR silage technology is one solution that can be optimized to improve the quality of feed origin of palm oil wastes. Through this waste treatment, will obtain a higher quality feed than the complete feed and fermented waste later. In addition, an increase in TMR silage feed quality will also have a positive impact on the production of methane gas is low. This will certainly reduce the level of methane gas emissions, especially ruminant livestock origin.

This paper is presented to explain the potential utilization of oil palm waste as feedstock TMR silage environmentally sound. Hopefully, this idea gained through the development of the concept of cattle-oil palm integration better than ever to support animal product sustainability in Indonesia.

## MATERIALS AND METHOD

Type of paper is the study of literature (library research). Data collected by the study reference that are relevant to the issues raised. Literature secondary data derived from research journals,

Department of Agriculture website, Bureau of Statistics Indonesia, and some relevant books. Data were analyzed by descriptive qualitative which involves four components namely, the data collection, data reduction, the data display, and drawing and verifying conclusions.

Process of presenting the issues to be discussed is the idea of describing the current situation related to the problem studied, the potential is there, the parties are considered to realize new ideas and technologies that will be played in the problem under study in order to obtain an alternative solution that is appropriate to apply the impact on the welfare of the society of Indonesian.

## RESULTS AND DISCUSSION

### Potential Analysis of Palm Oil Waste

The area of oil palm plantations in Indonesia ranks first largest in the world which was then followed by Malaysia. Every year, vast oil palm plantations also continue to experience the expansion due to the number of investors and companies to develop their business in this field. The situation is a separate opportunity for the livestock sector, especially in terms of feed supply. Now, if in terms of the number of waste generated and the application of technology is done, there is still a lot that needs to be fixed. Every year, the plantation area increased by about 14%. In 2012, oil palm plantation area of 5406.9 thousand hectares, larger than other commodities such as rubber, sugar cane, cocoa, coffee and the likes. The resulting waste oil are presented in the following table:

Table 1. Crop byproducts and processed palm oil for every ha/year

Biomass	Fresh (kg)	DM (%)	DM (kg)
Leaves no a stick	1.430	46,18	658
Midrib	6.292	26,07	1.640
empty fruit bunches	3.680	92,1	3.386
Fiber juice	2.880	93,11	2.681
Oil sludge	4.704	24,07	1.132
Palm oil cake	560	91,83	514
Total of Biomass (kg dry matter)	10.011		

Reference: Directur of feed livestock, 2011

Among forage plants often showed weed oil is also very potential. The potential waste oil is not only limited to the number of course, but the nutrient content of waste is also very abundant

potential to be developed further. Director of Feed Animal presents content palm oil waste in the table below.

Table 2. Nutritional composition of palm oil byproducts

Byproducts	DM	Ash	CP	CF	Fat	BETN	Ca	P	GE (kal/g)
	Dalam %								
Leaves	46,18	13,40	14,12	21,52	4,37	46,59	0,84	0,17	4461
Midrib	26,07	5,10	3,07	50,94	1,07	39,82	0,96	0,08	4841
Solid	24,08	14,40	14,58	35,88	14,78	16,36	1,08	0,25	4082
Oilcake	91,83	4,14	16,33	36,68	6,49	28,19	0,56	0,84	5178
Fiber	93,11	5,90	6,20	48,10	3,22	--	--	----	4684
TBK	92,10	7,89	3,70	47,93	4,70	--	--		---

Refrence: Directur of feed livestock, 2011

### Applications of TMR Silage Technology

Very viable alternative solutions to be applied to improve the quality of palm oil waste can be done preservation feed based by TMR silage. Total Mixed Ration (TMR) silage were made from raw complete waste palm oil has the potential to be a highquality animal feed. TMR has several advantages compared to single silage as made from grass silage or maize straw, among others, more easily compacted so that anaerobic conditions quickly achieved. In addition to the nutritional content of products can meet 70-90 % of the livestock and have fragrance preferred by livestock.

Complete ration silage making by utilizing byproduct of palm oil as well as some additional material (king grass, rice bran, rice bran, molasses and urea) is an alternative to ensure the availability of feed quality.

As revealed by DWI Cooke *et al.*, (2004), researchers from the Department of Animal Science University College Dublin have examined the use of TMR and concentrates comparison of quality and its effect on productivity and meat quality of ruminants. The results obtained showed that the administration apparently TMR generally showed better results than the concentrate.

Table 3. Effect of feeding on the body weight gain and carcass characteristics

Component	Totalmixedration andcontrol groups			Highconcentrategroup	
	Grass silage	Maize silage	Straw	Concentrate	Concentrate/straw
Drymatter (g/kg)	204	275	877	860	866
Crudeprotein	123	89	42	155	136
Ether extract	35.5	19.1	10.9	13.8	22.4
Ash	87.9	44.3	32.1	63.8	65.6
Aciddetergentfibre	389	322	591	-	
Starch	-	210	-	414	371

Reference: D.W.I.Cooke *et al.*, (2004)

### Optimizing of Livestock Eco-Friendly Environmental

Palm oil waste that is not processed still have bad quality. The low quality of the waste causes methane production in the rumen (CH<sub>4</sub>) and in line with the increases will negatively affect the productivity of ruminants. The higher crude fiber a forage, the lower and the higher digestibility methane emissions generated. According Bocazzi and Petterzon (1995), Formation of methane gas (metanaogenesis) in the rumen of cattle can cause energy loss of 15% of the total energy ingested chemicals and methane gas is emitted can contribute to the greenhouse effect of the atmosphere environment.

Through the application of TMR Silage technology, low-quality effluent quality can be improved, as has been demonstrated by several

studies. TMR silage can increase the number and total rumen VFA. According Roosena Joseph (2010), if the amount of rumen microbes increases, the feed fermentation also be optimized so that the resulting VFA also increased. It will decrease the production of methane gas that will be a positive influence on the future of environmental sustainability.

A variety of unconventional feed ingredients that other potential will support sustainable food availability. Through the potential of the palm oil waste, will be known to benefit the development of environmentally-friendly farming areas in Indonesia.

### CONCLUSION

Potential oil palm waste to be processed into Total Mixed Ration Silage. Each year, the



Indonesian oil palm plantations can produce each leaf waste without a stick of 3557.4 million tons, the midrib of 8867.32 million tons, empty fruit bunches of 18307.76 million tons, fiber of juice 14495.99 million tons, mud of palm oil amounted to 6120.61 million tons, and palm oil cake of 2779.2 million tons. If calculated, each year, a minimum of waste oil obtained palm oil of 54128.28 million tons.

The amount is believed to continue to increase throughout the year and is very well used form of TMR Silage ruminant feed. Of all that, it can be seen that the oil palm waste to contribute greatly to the independence of the national feed and be able to cope with food shortages when drought. In addition, the quality of feed-based TMR Silage, will be able to realize an environmentally friendly farms with low production of methane gas.

#### References

- Boccazzi, P. And J.A. Patterson. 1995. Potential for functional replacement of methanogenic bacteria by acetogenic bacteria in the rumen environment. IVth International Symposium on the Nutrition of Herbivores. Clermont-Ferrand, France, September 16- 17, 1995 p. 43.
- Badan Statistik Indonesia. 2013. Data luas perkebunan di Indonesia berdasarkan jenis tanaman. (26 Maret 2013)
- Direktorat Jenderal Peternakan. 2011. Buku Statistik Peternakan. Direktorat Jenderal Peternakan, Jakarta.
- Direktur Pakan Ternak. 2011. Pedoman Umum Integrasi Ternak-Tanaman. Departemen Pertanian, Jakarta.
- Dourmard JY, Rigolot C, Werf HVD. 2008. Emission of greenhouse gas, developing management and animal farming system to assist mitigation. Di dalam: Rowlinson P, Steele M, Nefzaoui A, editor. Proceedings of Livestock and Global Climate Change at The International Conference. Hammamet, 17-20 May 2008. Tunisia: Cambridge Univ Press. hlm 36-39.
- D.W.I. Cooke ,F.J. Monahan, P.O. Brophy and M.P. Boland. 2004. Comparison of concentrates or concentrates plus forages in a total mixed ration or discrete ingredient format: effects on beef production parameters and on beef composition, colour, texture and fatty acid profile. University College Dublin, Journal of Agricultural and Food Research 43:201–216.
- Reay D, Smith P, Armstel A. 2010. Methane and Climate Change. London, UK: Earthscan Ltd.
- Thalib, A Dan Y. Widiawati. 2008. Efek pemberian bakteri *Acetoanaerobium noterae* terhadap performans dan produksi gas metana pada ternak domba. JITV. 13: 273– 278.

## CALCULATION PENSION PLAN USING BENEFIT PRORATE METHOD (A Case Study of State Lecturers and Employees at Muhammadiyah Cirebon University)

<sup>1</sup>Setyo Wira Rizki and <sup>2</sup>Rifqi Hidayat

email: <sup>1</sup>setyo.wirarizki@gmail.com and <sup>2</sup>rifqi.math@gmail.com

### **Abstract**

*The difference of right which is accepted between lecturers who work in private university and public university is pension right after termination. The private university can manage their pension plan by following pension plan program. Calculation pension plan based on participant's salary and length of service using benefit prorate, which is included pension plan defined benefit. This research is applied for lecturers and employees at University of Muhammadiyah Cirebon.*

**Keywords:** defined benefit, benefit prorate, pension plan

### **I. INTRODUCTION**

The primary function of a pension plan is to provide income to employees in their retirement. Pension plans are not limited to providing retirement income, however, and all plans provide at least some of following types of benefit: (1) vested termination benefits, (2) disability benefits, and (3) death benefits, the latter consisting of either a lump sum benefit or an annuity to a surviving spouse or other dependants (winklevoss, 1993). In this country, mostly, the employees of the private university do not get their pension right after their retirement, because the government guaranteed the pension right only for the employees of the public university. This condition supports some employees to find the better job. It causes lack of loyal employees in the private university. The solution of this phenomenon is suggesting the private university to following pension plan program.

### **II. LITERATURES REVIEW**

#### **2.1. Pension Plan**

There are two types of pension plans: defined contribution (DC) and defined benefit (DB). A defined contribution plan, as the name implies, has a defined amount of employer and/or employee contributions set aside each year, often as a specified of salary. The employee's retirement benefit is determined by the size of accumulation at retirement. A defined benefit plan is one under

which the retirement benefit is the defined quantity, generally expressed in terms of the employee's salary and length of service. (winklevoss, 1993)

### **2.2. Actuarial Basic Function**

#### **2.2.1. Composite Survival Function**

The composite survival function represents the probability that an active plan participant survives in service for a given period, based on all of the decrement rates to which the employee is exposed. The probability of an active participant aged  $x$  surviving year is

$$p_x^{(T)} = (1 - q_x^{(m)})(1 - q_x^{(t)})(1 - q_x^{(d)})(1 - q_x^{(r)}) \quad 2.2.1$$

where,

$q_x^{(m)}$  = mortality rate       $q_x^{(t)}$  = termination rate  
 $q_x^{(d)}$  = disability rate       $q_x^{(r)}$  = retirement rate

The probability of surviving in active service for  $n$  years is equal to the product of successive one-year composite survival probabilities:

$${}_np_x^{(T)} = \prod_{t=1}^n p_{x+t}^{(T)} = \frac{l_{x+n}^{(T)}}{l_x^{(T)}} \quad 2.2.2$$

Where,

${}_np_x^{(T)}$  = the probability of person who is  $x$  years old and will work for  $n$  years later

$l_{x+n}^{(T)}$  = the number of the employees who are  $x + n$  years old

(Winklevoss, 1993)

#### **2.2.2. Salary Function**

If a pension plan has benefits expressed in terms of salary, it is necessary to develop salary-related notation and procedures for estimating future salary. The current dollar salary for a participant age  $x$  is denoted by  $s_x$ , and  $S_x$  represents the cumulative salary from entry age  $y$  up to, but not including, age  $x$ . Thus, for  $x > y$  we have

$$S_x = \sum_{t=y}^{x-1} s_t \quad 2.2.3$$

In order to estimate the dollar salary at age  $x$ , based on the employee's age- $y$  salary, the following formula is used:

$$s_x = s_y \frac{(SS)_x}{(SS)_y} [(1+I)(1+P)]^{(x-y)} \quad 2.2.4$$

Where,

$s_y$  = entry-age dollar salary

$(SS)_x$  = merit salary scale at age  $x$

$I$  = inflation rate

$P$  = rate of productivity reflected in the salary increases

(Winklevoss, 1993)

### 2.2.3. Benefit Function

The benefit function is used to determine the amount of benefits paid at retirement, vested termination, disablement, and death. The symbol  $b_x$  denotes the annual benefit accrual during age  $x$  to age  $x + l$  for an age- $y$  entrant, and is referred to as the benefit accrual function. The accrued benefit, denoted by  $B_x$ , of service is equal to the sum of each attained age accrual up to, but not including, age  $x$ . This function is called the accrued benefit function and is defined for  $x > y$  by

$$B_x = \sum_{t=y}^{x-1} b_t \quad 2.2.4$$

#### 1. Flat Dollar Unit Benefit

Under a flat dollar unit benefit formula,  $b_x$  is equal to the annual benefit payable per year of service. The accrued benefit is a years-of-service multiple of the benefit accrual, that is,

$$B_x = \sum_{t=y}^{x-1} (x-y) b_t \quad 2.2.5$$

#### 2. Career Average

The career average benefit formula has the following definitions for the benefit accrual and the accrued benefit functions at age  $x$ .

$$b_x = k \cdot s_x \quad 2.2.6$$

$$B_x = k \cdot S_x \quad 2.2.7$$

where  $k$  denotes the proportion of attained age salary provided as annual benefit accrual.

#### 3. Final Average

The final average benefit formula is somewhat more complicated. Let  $n$  denote the number of years over which the participant's salary prior to retirement is to be averaged, and let  $k$  equal the proportion of the average salary provided per year of service. The projected retirement benefit, assuming retirement occurs at the beginning of age  $r$ , is defined as

$$B_r = k(r-y) \frac{1}{n} \sum_{t=r-n}^{r-1} S_t \quad 2.2.8$$

(Winklevoss, 1993)

### 2.2.4. Pension Liability Measures

A variety of liability measures are associated with pension plans, each one having a specified purpose. Some liabilities represent the financial obligations of the plan, either on a plan termination or ongoing basis, while others simply represent mathematical by products of various actuarial cost methods used for funding pension plans. Although the letter are not liabilities in the true sense of the word, they are referred to as actuarial liabilities to distinguish them from the term liability as used in fields of finance and accalculation.

#### 1. Plan Termination Liability (PTL)

The plan termination liability (PTL), sometimes referred to as the plan's legal liability, is equal to present value of all accrued benefits, both for active and retired employees.

$$(PTL)_x = B_{xr-x} p_x^{(T)} v^{r-x} \ddot{a}_r \quad 2.2.9$$

where,

$B_r$  = accrued benefit as defined by the plan

${}_{r-x}p_x^{(T)}$  = probability of living from age  $x$  to age  $r$

$v^{r-x}$  = interest discount from age  $x$  to age  $r$

$\ddot{a}_r$  = present value, at age  $r$ , of a life annuity

#### 2. Actuarial Liability

A service proration of the participant's projected retirement benefit yielding a constant dollar benefit allocated to each attained age.

$${}^{BDr}(AL)_x = \frac{x-y}{r-y} B_{rr-x} p_x^{(T)} v^{r-x} \ddot{a}_r \quad 2.2.10$$

(Winklevoss, 1993)

### 2.2.5. Normal Cost

The normal cost represents the annual cost attributed to the current year of service rendered by active participants, with such costs being defined by one of several actuarial cost methods. A service

proration of  $B_r$  which produces a constant dollar benefit accrual is,

$${}^{BDr}(NC)_x = \frac{B_r}{r-y} r^{-x} p_x^{(T)} v^{r-x} \ddot{a}_r, \text{ for } y \leq x < r \quad 2.2.11$$

(Winklevoss, 1993)

### 2.3. Interest Function

The interest function is used to discount a future payment to the present time. It plays crucial role in determining pension costs. If  $i_t$  is the interest rate assumed for the  $t$ -th year, the present value of one dollar due in  $n$  years is given by

$$\frac{1}{(1+i_1)(1+i_2)\dots(1+i_n)} \quad 2.3.1$$

$$\text{and if } i_1 = i_2 = \dots = i_n, \text{ we have} \quad 2.3.2$$

$$\frac{1}{(1+i)^n}$$

(Winklevoss, 1993)

## III. RESEARCH METHODOLOGY

This research is grouped in actuarial mathematics science which focused on mathematics pension. The aim of the research is to count actuarial liability and normal cost using benefit prorate method.

## IV. RESULT

### 4.1. The Assumptions

The assumptions is used to count pension plan using benefit prorate method, those are :

1. The rate of interest is 7,25%.
2. Salary rate is 2,5 % per year.
3. Pension time at age 65.
4. Appreciation rate is 1% per year.

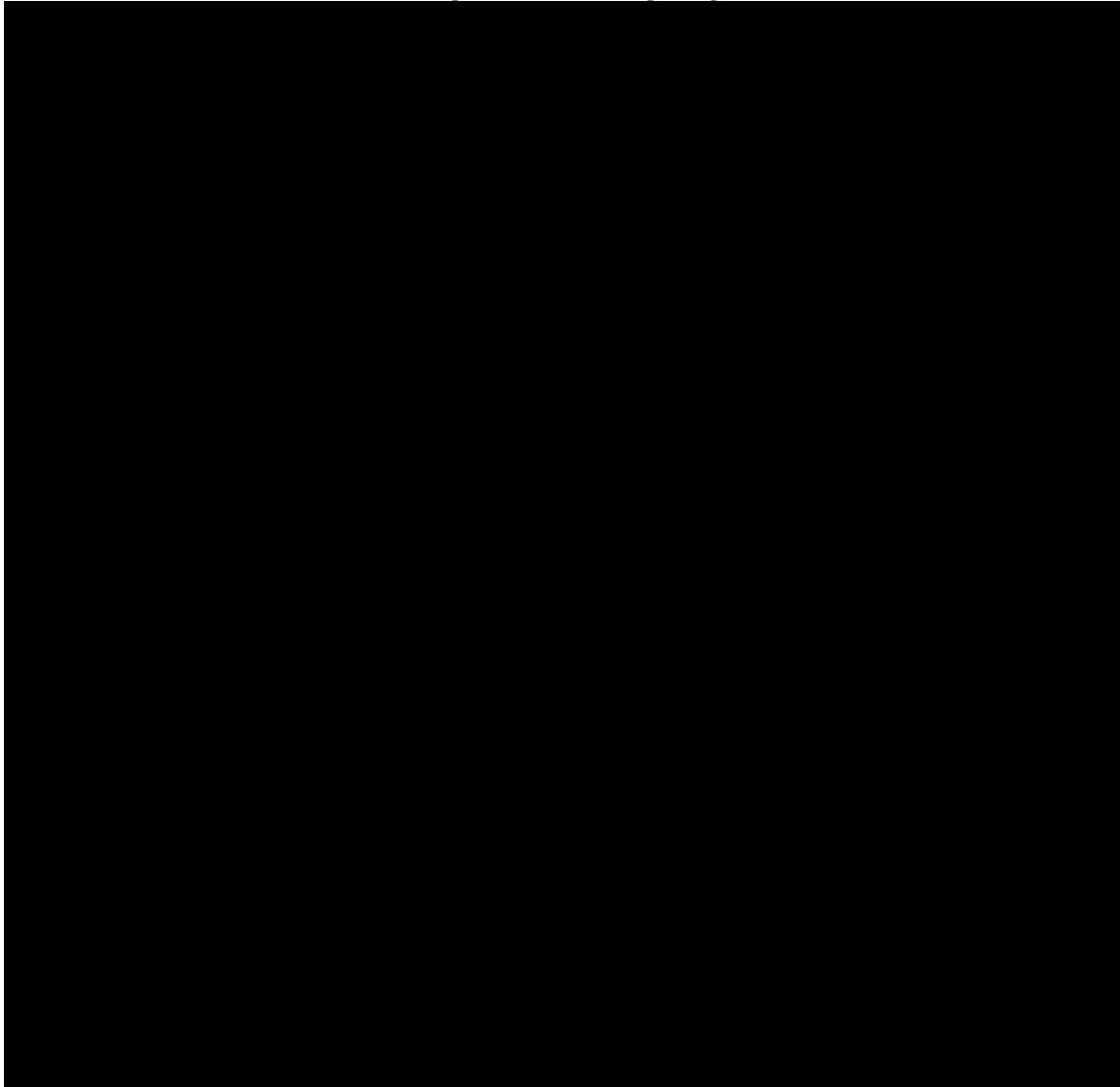
### 4.2. Data Analysis

Table 4.2.1. Calculation pension plan of participant number 001

Number	: 001		
$y$	: 24	$r$	: 65
$s_y$	: Rp. 1.160.000	$B_r$	: Rp. 14.147.702,53
$x$	: 26	$S_r$	: Rp. 565.908.101
$s_x$	: Rp. 1.403.600	$k$	: 0,025
$S_x$	: Rp. 2.436.000	$i$	: 0,0725
$b_x$	: Rp. 35.090	$v$	: 0,932400932
$B_x$	: Rp. 60.900		

referee : Human Resource Department, counted in 2013

Table 4.2.2. The complete calculation of participant number 001



- 1.1) The first participant entered as employee in muhammadiyah Cirebon university at age 24 with salary as much Rp. 1.160.000.
- 1.2) At present, He is 26 years old with salary scale Rp. 1.403.600 and salary appreciation rate as 1% on each year. The cumulative salary from age 24 to 26 years is Rp. 2.436.000.
- 1.3) Amount of benefit from 26 to 27 years for a person who entered as employee at age 24 years is Rp. 35.090 with salary accrued rate is 2,5 %.
- 1.4) The number of accrued benefit function at age 26 which is with salary rate as 2,5 %.
- 1.5) The pension assumption is 65 years, so it will gain an accrued benefit function on that age is an accumulation of  $b_{65}$  from age 24 to 64, for  $x > y$  as much Rp. 14.147.702,53 and the cumulative salary at age 24 to 65 is Rp. 565.908.101.
- 1.6) The interest rate assumption is 7,25 % and the present value is 0,932400932.
- 1.7) Actuarial Liability and Normal cost at age 26 are Rp. 38.223,88 and Rp. 19.111,94 respectively.

## V. CONCLUSION

The calculation of pension plan for lecturers and employees at private university, especially, at

University of Muhammadiyah Cirebon gives understanding and information to employees and employer about benefit and liability from employees to employer if they will be the participants of pension plan program. Using benefit prorate method is affected by salary and length of service from entry age to retirement age.

## References

- Bowers, N.L. 1997. "Actuarial Mathematics". The Society Of Actuaries, Schaumburg, Illinois.
- Johansyah, Difi. A, 2013. Tinjauan Kebijakan Moneter (TKM). [http://www.bi.go.id/web/id/Ruang+Media/Siaran+Pers/sp\\_153013\\_dkom.htm](http://www.bi.go.id/web/id/Ruang+Media/Siaran+Pers/sp_153013_dkom.htm)
- Nurrochman, Choiril. 2008. Tesis : "Penentuan Dana Pensiun dengan Metode Accrued Benefit". S2 Matematika UGM, Yogyakarta.
- Nurmailis, Satyahadewi dan Mara, 2012. "Penggunaan Metode Benefit Prorate pada Program Pendanaan Pensiun Manfaat Pasti (Defined Benefit)". Buletin Ilmiah Mat.Stat dan Terapannya, volume 01, hal 41-46. Universitas Tanjungpura, Pontianak.
- Winklevoss, Howard E. 1993. "Pensiun Mathematics with Numerical Illustrations". Pensiun Reseach Council, The University Of Pennsylvania and University Of Pennsylvania, Philadelphia.

## PROFILE OF MICROENTERPRISES CREATIVE SOUVENIR PROCESSED COCONUTWASTE MANAGED BY POOR ARTISANS FARMERSIN RURAL

Dumasari<sup>1</sup>, Tri Septin Muji Rahayu<sup>2</sup>, Sulistyani Budiningsih<sup>3</sup>

<sup>1,3</sup> Lecturer of Agribusiness Program Study, Faculty of Agriculture, University of  
Muhammadiyah Purwokerto

<sup>2</sup>Lecturer of management Program Study, Faculty of Economic, University of  
Muhammadiyah Purwokerto

Email: dumasarilumongga@yahoo.com

### **Abstract**

*The goal of this reseach is to review and find the profile of microenterprises creatice souvenir processed coconut waste managed by poor artisans farmersin rural. This research use the design of applied research. The research method is grounded research with a combination of qualitative and quantitative approaches. Location research intentionally set in a rural Sub district Baturaden, Banyumas District and Purbalingga Wetan Sub District, Purbalingga District, Central Java Province. The types of data collected is primary and secondary. Mechanical determination of informants was purposive sampling. Respondents were selected by simple random sampling technique. Key informants determined with rolling snowball technique. Techniques of processing and analyzing implemented in a qualitative and quantitative. Qualitative data analysis techniques using the Interactive Model of Analysis. Quantitative data were analyzed using descriptive statistics techniques. The research results revealed that the profile of micro enterprises creative souvenir processed from waste of coconut managed by poor artisans farmersin rural at Baturaden and Purbalingga Wetan shows the similarities and differences in some cases. Micro enterprises of kreatif souvenirs processed coconut waste managedby poor artisans farmersin Baturaden rural has a profile that is to show various limitations on the some issue: capital, quality and quantity of products, technology, profit, price and market. In contrast to that found in Baturaden, micro business profile creative souvenir refined coconut waste managed in Purbalingga Wetan by poor artisans farmersare adequate in terms of issues: labor, quality and quantity of products, technologies, prices, market. Based on micro business profile is known that the informants often have limitations in problems of capital and raw materials.*

**Keywords:** *profile; micro enterprises; creative souvenirs; coconut waste*

### **INTRODUCTION**

Various attempts have been made by several parties for intensive empowerment to farmers free of poverty. One strategic move that is applied to involve poor farmers in diversifying livelihoods. A variety of productive activities can be developed in the farming community to take advantage of the potential of local resources.

Poor farmers realize the wealth of natural resources available in the surrounding rural environment can essentially be used as raw material variety of economically valuable products on the market. However, the ability of poor farmers to cultivate limited. Access the knowledge and skills to the adoption of product processing technology that belongs to poor farmers minimal. Information on additional sources of capital, designs and motifs products, business management strategies, market reach, promotional techniques and fabric of the business network as untouched a range of poor farmers. Thus social reality is not much different with the research findings and Watemin Dumasari (2009) followed Dumasari and Watemin (2010) in rural of Banyumas despite the fact that show poor farmers have been able to manage the business of microtourism souvenirs goods from waste agricultural but not the acquisition of additional revenue means for increasing economic families.

The products resulting by poor poor artisans farmersare often not appropriate with market trends so that the sale value is much lower than the market price. The design and motif souvenir products produced poor farmers less varied due to new technology utilized is just able to modify the monotonous patterned products. Poor farmers have weak access to inormasi and the market price. Its bargaining power is also weak when conducting transactions with merchants. The product quality is still low.

Waste coconut is one type of agricultural waste which has been often wasted just so prone to be pollutants that contaminate the surrounding natural environment. However, reversed negative function as pollutant turns coconut waste has economic potential to be used as raw material for various forms of souvenirs with creative designs and motifs. Part of processed waste oil is utilized such as: shell, husk, dried leaves, sticks, bunches of flowers (Virgin), the roots and the rest of sawn timber and *glugu* (coconut trees). Great potential for coconut waste used as raw material of creative souvenirs is also based are abundant in the countryside. For it is necessary to do research that study how profile of micro enterprises creative souvenir processed coconut waste by poor artisans farmersin rural?

#### RESEARCH GOALS

Based on the urgency of the problem, this research has a specific purpose. The goal of this research is to review and find the profile of micro enterprises creative souvenir processed coconut waste managed by poor artisans farmersin rural.

#### RESEARCH METHODS

This research use the design of applied research. The research method is grounded research with a combination of qualitative and quantitative approaches. Location research intentionally set in a rural Sub district Baturaden, Banyumas District and Purbalingga Wetan Sub District, Purbalingga District, Central Java Province. The types of data collected is primary and secondary. Mechanical determination of informants was purposive sampling. Respondents were selected by simple random sampling technique. Key informants determined with rolling snowball technique. Collection techniques are in-depth interviews were conducted with the data source. Interviews based on a structured questionnaire that had been prepared beforehand. In addition, other primary data collection techniques used the Focus Group Discussion (FGD). Data collection techniques of secondary data analysis is intended to obtain data derived from: books, records, documents, books, journals, research results relevant to the theme of the research comes from government and village/district and others. Techniques of processing and analyzing implemented in a qualitative and quantitative. Qualitative data analysis techniques using the Interactive Model of Analysis (Miles and Huberman, 1991). Quantitative data were analyzed using descriptive statistics techniques.

#### RESULTS AND DISCUSSION

Microenterprises creative souvenir processed from waste of coconut managed poor artisans farmers in Baturaden and Purbalingga Wetan have profiles with a variety of criteria. Some criteria for the micro enterprises profile creative souvenir processed from waste of coconut showed similarities in various matters relating to: the use of labor, primarily from the nuclear family environment, extended family and neighbors nearby. It's just at the poor artisans peasant in Purbalingga Wetan when product demand increases, additional labor is absorbed from some other craftsmen farmers who join the membership bond Manunggal Karya Group. Prevailing wage system is also not different because the wage rate is determined from the volume of work done in producing the product. Thus wage system in the two sites known as piece rate (*upah borongan*).

Profile microenterprise creative souvenir from coconut waste processed in Baturaden and Purbalingga Wetan arriving in some respects the amount of labor. The use of hired labor in Baturaden relatively less than in Purbalingga Wetan. This is because the volume of coconut waste processing work into a variety of more creative souvenir in Purbalingga Wetan. Another difference is revealed from the use of technology among poor artisans peasant began preproduction stage, production, finishing to packaging and marketing. The informant in Baturaden craftsmen still using traditional technology. Marketed products tend to semifinished or have not gone through the process of finishing and packaging. In contrast to the application of the technology conducted in Purbalingga Wetan informant, who has used various types of modern and semimodern technology to improve the quality of the product.

Status and the amount of capital used informants in the two sites are different. The informants in Baturaden have smaller capital that most (50 percent) comes from its own capital. Only a few informants who claimed to use the loan capital from traders bersumberr subscription product sales. In contrast, the amount of capital in the production of the informants Purbalingga Wetan larger and the majority (> 50 percent) is on loan from Manunggal group work or other potential borrowers. In Table 2 details the criteria observed profiles of each poor artisans farmers who researched both of Baturaden and Purbalingga Wetan.



Table 2. Profile of Microenterprises Creative Souvenir Processed from Coconut Waste

No.	Criteria Profile	Baturaden	Purbalingga Wetan
1.	Labor		
	Labor Resources	Labor sources of nuclear family extended family and neighbors close	nuclear family , extended family, close neighbors and fellow poor artisans farmers of Manunggal Karya Group members
	Number of Workers (people)	3-6 people per working day	4-8 people per working day
	Wage System	Wage bulk wholesale	Wage bulk wholesale
2.	Application of Technology		
	Pre Production Stage	The majority of traditional	The majority of semi modern
	Production Stage	The majority of traditional	The majority of modern
	Finishing Stage	The majority without finishing stages	The majority of modern
	Packaging Stage	The majority without packaging stage	The majority of semi modern
3.	Capital		
	Capital Resources for Capital Resources for Micro	Majority 's own services to minority bold traders borrow loan capital	The majority of loan capital Manunggal Karya Group and other potential borrowers A small portion of equity capital
	Total Capital Microenterprises	Average Rp 250.000-Rp 750.000	Average Rp 750.00-Rp 4.500.000
4.	Microenterprises Management Strategies	Managed conventional almost without effort (people) business	Simple management strategy (group)
5.	Microenterprises Products		
	Product Types	1-3 product types	>3 product types
	Product Design	Tends to remain invariable	Adjusted market trend information
	Motive of Products	Less variatif	Variatif
	Product Quality	Not good	Good
6.	The volume of product per unit of product working days	25-50 units of product	>50 units of product
7.	Reach the Market	Collector costumer traders	Exhibitions, tourist markets, traders, consumers in/out of town
7.	Level Price	Rp 25.000 per kodi	Rp 40.000 per kodi
8.	Profit	Rp 25.000-Rp 50.000 per working day	>Rp 50.000 per working day

Source: Adapted from primary data in 2013

Based on other information in Table 2 revealed that the criteria that indicate there are differences in microenterprise management system. Informants in Baturaden not perform proper management system. Creative souvenirs microenterprises managed refined palm waste management systems tend to use conventional household patterned. Poor artisans farmers work individually and do not yet have a network working group. Meanwhile, in Purbalingga informant Wetan informants have begun to use business management system until there is a bond group collectivity that

characterize the business relationship between the poor artisans farmers produce better quality products. The informants in Purbalingga Wetan has had its own marketing space facilities owned Manunggal Karya Work. The marketing system is no longer just passing *gethok tular* but developed through the use of information technology media mobile and Internet networks.

Another difference observed from the type, pattern, design and creative souvenir volume of processed waste product of coconut. Informants in New Baturaden able to produce one to two types of

products with motifs and designs which tend to be monotonous every time production. The volume of the resulting product also looked much less than that produced in Purbalingga Wetan informants. Therefore, the quality of the products produced informant creative souvenir of Purbalingga Wetan better because motifs and designs are varied according to the market trend. Microenterprises of

creatif souvenirs processed coconut waste by managed poor artisans farmers in Baturaden rural has a profile that is to show various limitations on the some issue: capital, quality and quantity of products, technology, profit, prices and market. At Figure 1 shows the profile of micro enterprises creative souvenirs developed informants in Baturaden.

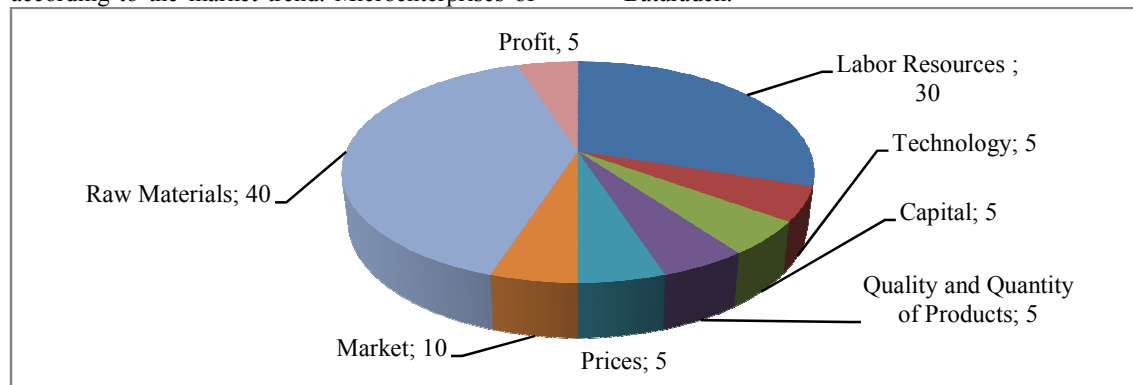


Figure 1. Profile Micro Enterprises Creative Souvenir Processed Coconut Waste in Rural of Baturaden

Behind the limitations of the various things that affect the ability of the micro-enterprise productivity from the profile shown in figure 1 is known poor artisans farmers in Baturaden have the capability to be developed especially in the availability of raw materials and labor. However, the availability of skilled labor need to be equipped to process waste coconut into various types of creative souvenirs sold at some market share.

In contrast to that found in Baturaden, micro enterprises profile creative souvenir refined

coconut waste managed in Purbalingga Wetan by poor artisans farmers are adequate in terms of issues: labor, quality and quantity of products, technologies, profit, prices, market. Based on micro business profile is known that the informants often have limitations in problems of capital and raw materials. A more complete profile of the micro enterprises of creative souvenir in Purbalingga Wetan can be seen in Figure 2.

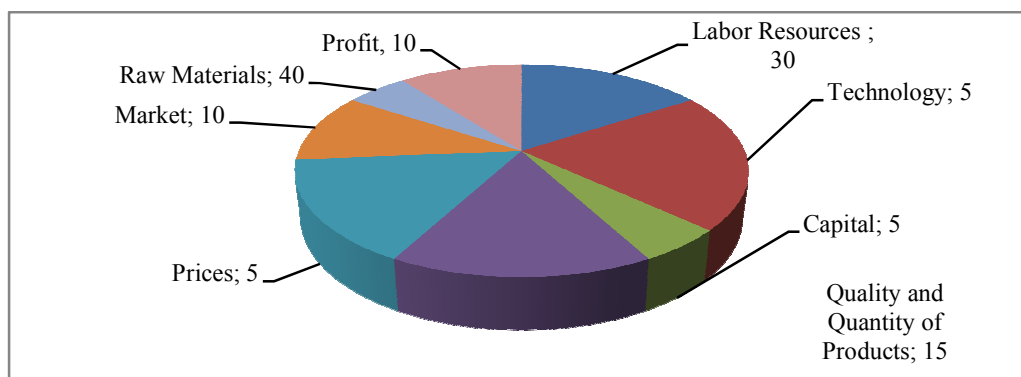


Figure 2. Profile Micro Enterprises Creative Souvenir Processed Coconut Waste in Rural of Purbalingga Wetan

Livelihood diversification is done informants in the two sites has important functions for the management of productive enterprises in rural as described by Sitorus, et al (2004). Empowerment of poor farmers through the development of micro enterprises of creative souvenir coconut waste processed with the design modification technology appropriate with market trends require a strategy that is not only economically motivated but also need to be accompanied by social motives, culture and the environment as expressed by Sadono (2008). The resulting product from coconut farming implements vertical diversification have greater market opportunities for producing competitive products and value-added economically adequate (Tarigan, 2005).

#### CONCLUSIONS AND IMPLICATIONS

Profile microenterprise creative souvenir processed from coconut waste managed by poor artisans farmers in rural of Baturaden and Purbalingga Wetan show the similarities and differences when observed in some cases. Equations contained in the use of labor from the nuclear family environment, extended family, neighbors nearby. Prevailing wage system among poor artisans farmers also shows that equation using wholesale debt bondage system. Differences that characterize micro enterprises profile found at: raw materials, technology, capital, management strategies, quality and quantity of products, prices and markets as well as profits.

Inaction poor artisans farmers develop micro was influenced capital issues and technology. Therefore, it needs a real effort to increase awareness and the ability of artisans farmers in accessing capital sources of information utilizing coconut waste processing technology into creative souvenirs and quality varied.

#### References

- Dumasari and Watemin. 2009. Pemberdayaan Petani Miskin melalui Pengembangan Usaha Mikro *Tourism Souvenir Goods* dari Limbah Pertanian dengan Pemanfaatan Teknologi Modifikasi Produk Ramah Lingkungan. Competitive Grant Research Report Phase II. DIKTI. Jakarta.
- and Watemin. 2010. Pemberdayaan Petani Miskin melalui Pengembangan Usaha Mikro *Tourism Souvenir Goods* dari Limbah Pertanian dengan Pemanfaatan Teknologi Modifikasi Produk Ramah Lingkungan. Competitive Grant Research Report Phase III. DIKTI. Jakarta.
- Miles, M. B., and A. M., Huberman, 1991. Designing Qualitative Research. Mac Graw Hill Company. New York.
- Sadono, Dwi. 2008. Pemberdayaan Petani: Paradigma Baru Penyuluhan Pertanian di Indonesia. Article Published in the Journal of Counseling Volume 4 Number 1. March 2008. The Program of Study Ilmu Penyuluhan Pembangunan. Bogor Agricultural Institute. Bogor.
- Sitorus, Felix, MT., Endriatmo Soetarto, Juara P., Lubis, Ivanovich Agusta and Rachmat Pambudy. 2004. Agribisnis Berbasis Komunitas. PT. Sang Hyang Seri. Agrarian Studies Center Research Institution Agricultural Institute. Bogor.
- Tarigan, Doah Dekok. 2008. Diversifikasi Usahatani Kelapa Sebagai Upaya Untuk Meningkatkan Pendapatan Petani. Article Published in the Journal of Perspektif Volume 4 Number 2. December 2005. Research Institute. Department of Agriculture. Bogor.

## DEVELOPMENT OF FUSARIUM DISEASE CONTROL TECHNOLOGY WITH BIOLOGICAL AGENT IN MAS CULTIVAR BANANA SEEDLINGS RESULT *IN VITRO* CULTURES

Anis Shofiyan and Gayuh Prasetyobudi

### Abstract

Based on the data of General Director of Production and Horticulture, the damage of plantation areas in banana plantation centers in Indonesia always increases in years, this is due to *Fusarium* attack caused by fungus *Fusarium oxysporum* and causing damage of 30-70 % banana plantation areas. In Banyumas area, the development of banana, especially the golden banana as local prime commodity regions continued to decrease due to the lack of qualified seed availability that was free from pathogen, especially free from *Fusarium* caused by the fungus *Fusarium oxysporum*. The effort of improving growth and development systems on plant using biological agent should be started early (acclimatization) to crops grown on infected area, by utilizing *Trichoderma*, *Gliocladium* and *P. Fluoroscens* as biological control of wilt disease due to *Fusarium* pathogen in banana plants. This study will effort to obtain disease control technology of *Fusarium* on banana by effective and environmentally convivial.

The research was conducted at the research farm of Agriculture Faculty, University of Muhammadiyah Purwokerto, in 8 months. The research design was a randomized block design (Random Complete Block Design) consisting of 2 treatments, the first treatment was a type of antagonist biological agent consisting of 3 cedars, and the dose treatment of antagonist biological agent with combination of treatments as follows: (T.25) Biological Agent of *Trichoderma* sp with a dose of 25 g / polybag, (T. 50) *Trichoderma* sp with a dose of 50 g / polybag ; (T.75) *Trichoderma* sp with a dose of 75 g / polybag ; (PF.10) *Pseudomonas fluorescens* with a dose of 10 ml / l of water, (PF.20) *Pseudomonas fluorescens* with a dose of 20 ml / l of water ; (p.30) *Pseudomonas fluorescens* with a dose of 30 ml / l of water, (G.10) *Gliocladium* sp with a dose of 10 g / polybag ; (G.20) *Gliocladium* sp with a dose of 20 g / polybag, and (G.30) *Gliocladium* sp with a dose of 30 g / polybag plus chemical fungicide treatment as a comparison (control +), and without fungicide (control -)

The application of biological agent *Trichoderma*, *Gliocladium* and *P. Fluoroscens* during the research was proved to provide the inhibition of *Fusarium* attack on seeds, showed by the absence of symptom of its disease until the end of the research though the population of fungus *Fusarium* pathogenic in the soil was quite high. This was possible because of the formation of colonization between biological agent with the root system so it caused inhibition in contact between pathogen with root system of banana plant that protected the root from pathogenic infection of *Fusarium* as the cause of wilt disease. Treatments of *Trichoderma*, *Gliocladium* and *P. Fluoroscens* had significant effect on plant's height, stem's diameter, leave's number, root's number, but had no significant effect on the parameter of root's length and fresh plant's weight. However, *Trichoderma* application with a dose of 50 g / hole was able to provide most excellent effect on almost all observation parameters at the end of the research.

**Keywords:** Seed of Pisang Mas, *Fusarium*, biological agent, bio control technology

### INTRODUCTION

BananaMas, "literally gold", (*Musa paradisiaca* L) is one of the many banana plants developed in Banyumas, especially in Baturraden District. This type of banana is favored by the people because of its sweet tastes, yellow flesh, fragrance and tenderness. With these specific characteristics, this type of banana has an economically-promising commercial value.

However, the banana farmers in the area have problems in the provision of a qualified banana plant seeds and of a technology as a biological control of rotting diseases by *Fusarium oxysporum*. The farmers' lack of knowledge on the use of technology in the biological control of *Fusarium* diseases exacerbates the damage to banana plantations in the district.

An efforts made to suppress wilt disease in banana plants after planting in the field is the use of control technologies of wilt disease that are environmentally friendly (biological control). A

biological control technique is one alternative to consider, because it maintains a balance of the environment with non-pathogenic microorganisms as potential control agents to protect the plant during its life cycle (Baker and Cook 1974; Silva et al, 2004; Yan et al, 2004). Biological control is proven effective in increasing the growth of some crop commodities, in addition to being able to control various types of pathogens (especially soil borne pathogens) (Haas and Defago 2005 cit Siddiqui, 2006).

The biological control of diseases of *Fusarium* can be done by adding antagonists and organic matter into the soil (Rustanti et al, 2004). A treatment of *Trichoderma harzianum* can inhibit the incubation period of *Fusarium oxysporum* on ginger (Soesanto et al, 2005). Plant resistance to pathogens is indicated by resistance to pathogen infection, but it may limit the activity of the pathogen, so that pathogens cannot grow and cannot cause any severe damage (Agrios, 2005, Cit Soesanto, 2009). Chemical resilience shown by the formation of chemical compounds capable of preventing the growth and development of the pathogen, which can be Pathogenesis Related Proteins, secondary metabolite compounds of lachnoides, phenols, flavonoides, glycosides, phytoalexin, and so on (Chaerul, 2003 cit, Susanto, 2009). Generally resistant plants contain the chemical compounds with a higher concentration than other plants (Agrios, 2005). The use of biological agents antagonist is one alternative to improve the plant resistance.

The purpose of this study is: 1) to determine the effect of antagonistic biological agents to the increased resistance of the banana *Mas* seeds against *Fusarium* wilt disease, 2) to study the effect of biological agents antagonistic to *Fusarium* wilt disease suppression in the seed of the banana *Mas*, 3) to determine the effect of antagonistic biological agents to the growth of the banana *Mas* plant seeds.

## METHODS

### 1. Time and Place

The experiment was conducted at the experimental farm of the Faculty of Agriculture UMP from June until November 2013.

### 2. Research Material

The materials used in the study are culture bottles; analytical scales; scalpels and blades; tweezers; pH meter; lights spirits; measuring cup; stir; Parant size plastic shade 50 %, plastic lid, 40 cm-diameter polybags; oven; scales; ruler; calipers; alcohol; *Fusarium* infected soil, compost seed

tissue culture banana plants; cultures of *Trichoderma*, biological Agency of *Pseudomonas fluorescens* in the form of BIO - PF, and biological agents of *Gliocladium sp*, and corn culture media.

### 3. The design of experiments

The design used was Random Complete Block Design consisting of 2 treatments, i.e. the first treatment is a type of antagonist biological agents consisting of 3 types and the second treatment is the dosage of antagonist biological agents with the following combination of treatments: (T.25) biological agent of *Trichoderma sp* at a dose of 25 g/polybag, (T.50) *Trichoderma sp* with a dose of 50 g/polybag; (T.75) *Trichoderma sp* with a dose of 75 g/polybag; (PF.10) *Pseudomonas fluorescens* at a dose of 10 ml/l water, (PF.20) *Pseudomonas fluorescens* at a dose of 20 ml / l of water; (PF.30) *Pseudomonas fluorescens* at a dose of 30 ml / l of water, (G.10) *Gliocladium sp* at a dose of 10 g /polybag; (G.20) *Gliocladium sp* with a dose of 20 g/polybag, and (G.30) *Gliocladium sp* at a dose of 30 g/polybag plus chemical fungicide treatment as a comparison (control +), and without fungicide (control -).

The data obtained, then, was analyzed by analysis of variance at the 5% level. If there is a significant difference, it was then tested further with the smallest Significant Difference test (LSD) at the 5% level.

## 4. Research Implementation

### Medium

#### a. Planting medium I

Planting medium used is sterile river sand, which was previously washed thoroughly to remove dirt and mud. Furthermore, the sand was sterilized by heating for 2 hours. Then, the sand was cooled and put into polybag 40 cm diameter to fill the three fourth ( $\frac{3}{4}$ ) part of the polybag.

#### b. Planting medium II

Planting medium used in the 2nd planting is the fungus of *Fusarium oxysporum*-infected soil from the field sites where the banana stricken by the *Fusarium* diseases in the Baturaden District. The infected soil was mixed with compost in a ratio of 2:1 and it was placed into a polybag of 40 cm diameter.

#### c. Application of Biological Agents of *Trichoderma* and *Gliocladium*

Biological agents of *Gliocladium sp* and *Trichoderma* in the form of culture were applied by burying it in the planting media (the first and the second planting medium) in the polythene bags to be used in research. The dosages of *Gliocladium sp*

and *Trichoderma* were given in each planting hole of the polybags according to the treatment.

#### d. Application of *Pseudomonas fluorescens*

The biological agents of *Pseudomonas fluorescens* in the form of Bio PF were applied by showering the suspension of Bio PF on the soil in polybags at the time of planting (the first and the second planting medium). The dosages of Bio PF given in a polybag per planting hole were 10 ml/l, 20 ml/l and 30 ml/l (according to the treatment).

#### 5. Observed variables

Observations were made after the crop was planted 2 weeks. The observations include:

**1. Observations of plant growth** includes plant height, number of leaves, stem diameter, number of roots, root length, fresh plant weight, number of diseased seedlings.

#### 2. Observation of Intensity Attacks

The intensity of *Fusarium* wilt disease was calculated by looking at the severity of the attack. It was calculated from the beginning of treatment / inoculation until the appearance of the attack. The calculation of disease severity using a category of

attack or scale of damage using the scale of Mak et al (2008), with the following criteria;

- 1 = no infection (healthy plant)
- 2 = slightly yellowing leaves
- 3 = the majority of the leaves turn yellow
- 4 = all leaves yellowing
- 5 = plant dead;

for symptoms at the root, the following criteria were used:

- 1 = tissue on or around the hump part has no color change
- 2 = no discoloration on the stump, there is a color change in the section dealing with the root
- 3 = discoloration 0-5 %
- 4 = discoloration of 6-20 %
- 5 = change in color of 21-50 %,
- 6 = change in color of > 50 %
- 7 = discoloration reaches the plant stump
- 8 = dead plant

The severity of disease (disease index severity / DSI) in the leaves and roots by Mak et al (2008) was as follows:

$$DSI = \frac{\sum (\text{the value of the category} \times \text{number of seeds per attack category})}{\sum (\text{number of seeds observed})}$$

Table 2. Specification of DSI scale

DSI scale for LSI	DSI scale for RDI	Remarks
1	1	Resistant
1,1 - 2	1,1 - 3	Tolerant
2,1 - 3	3,1 - 5	Susceptible
3,1 - 4	5,1 - 8	Highly Vulnerable

The rate of infection is calculated based on the formula of van der Plank (1963) cited Soesanto (2009), namely:

$$r = 2.3 / t (\log 1/(1-X_t) - \log 1/(1-X_0)), \text{ with:}$$

r = rate of infection

X<sub>0</sub> = the proportion of early disease

X<sub>t</sub> = the proportion of the disease at time t

T = time of observation,

The effectiveness of antagonist agents is calculated based on the formula (Djaya et. al, 2003) :

$$Ea = (IPc - IPt) / IPc \times 100 \%, \text{ with}$$

Ea = the effectiveness of antagonist

IPc = intensity of the disease in the control / no treatment,

IPt = The intensity of the disease on treatment

The population density of *Fusarium* was calculated at the end of the study by counting directly 1 g of soil samples dissolved in 9 ml of sterile water. It was counted after the soil solution samples grown into PDA medium in a petri cup. Observations on the content of phenolic compounds were done for glycosides, saponins, and tannins at the end of the study. The glycoside test was conducted with Keller-Kiliani reagent, and the tannin test identified by test and reagent FeCl<sub>3</sub> gelatin, a saponin test was conducted using foam / froth test (the froth test).

The observations of antagonist agents in plants by isolating FoC from the root and tuber. They were cut, soaked in a solution of 1 % chlorox for 5 minutes, washed 2 times with distilled water, and dried on sterile filter paper. Once they were

dry, the materials were cut 1 cm along and were isolated on PDA medium in petri cups. Each petri was filled with 10 pieces of roots or tubers and they were incubated a minimum of 3 days. The isolates growing were observed by microscopy with lactophenol cotton blue staining. In addition, an observation was done by creating a cross-sectional cut on the root, which is stained with *lactophenol cotton blue*.

## RESULTS AND DISCUSSION

### A. Results

In general, the results showed that there had not been any attack symptoms of *Fusarium* wilt on banana plant seeds cultured *in vitro* planted in the second planting medium of *Fusarium* fungus-infected soil in all treatments given. However, treatment of biological agents of *Trichoderma*, *Gliocladium* and *Pseudomonas fluorescens* to control of the wilt disease of *Fusarium* in the banana plant seedlings are quite effective. This was seen from the low damage found in the roots of the banana plant seedlings by the disease until the end of observation. It was also the case for the plant growth parameters, in which the vegetative growth parameters such as plant height, stem diameter, number of leaves, number of roots, and fresh plant weight showed good results with the application of *Trichoderma*, *Gliocladium* and *Pseudomonas fluorescens*. For more details, the parameters observed are presented below:

### a. Effect of Treatment to the Intensity of *Fusarium* Wilt Attack

#### 1. Analysis on the Contents of Phenol Compounds, *Fusarium* population density in soil and the Colonization of Biological Agents in the tissue of plant roots.

The results showed that the content of phenolic compounds qualitative testing in plant tissues gave positive results (Table 2).

The results of testing the content of phenolic compounds in plant tissue of the bananas Mas at the end of the study showed that the content of tannins, saponins and glycosides in each treatment gave that varied qualitative data results. However, in general the contents of tannins, saponins and glycosides were highest in the control treatment (T0).

The Observations qualitative test of the content of phenolic compounds in the plant tissues in Table 5 indicated that the treatment of biological agents of *Trichoderma*, *Gliocladium* and *Pseudomonas fluorescens* on banana plant seedlings *in vitro* cultures are able to induce the formation of biochemical resistance in the form of the growth of saponins, tannins and glycosides in the plant tissue. This is in a line with the research premises of Soetanto and Rahayu (2009), of whom results of qualitative tests showed an increased content of glycosides, tannins and saponins in plants treated with supernatant antagonistic fungus *Trichoderma harzianum*-banana isolates, *T. harzianum*, ginger isolates, and *T. harzianum* of ginseng isolates.

Table 2. Treatment Effect of *Trichoderma*, *Gliocladium* and *Pseudomonas fluorescens* to the Qualitative Content Test of Phenol Compound in the Banana Plant Seed at the End of the Research.

No	Code	Test of Qualitative content of Phenol Compounds		
		Tanin	Saponin	Glikosida
1	(T.25)	++	+++	++
2	(T.50)	++	++	+
3	(T.75)	+++	+++	+++
4	(PF.10)	+	++	++
5	(PF.20)	+	++	++
6	(PF.30)	+	+++	+++
7	(G.10)	++	+	++
8	(G.20)	++	++	++
9	(G.30)	++	++	++
10	(K.1)	++	++	+
11	(K.0)	+++	+++	+++

Note: (T.25) *Trichoderma* sp at a dose of 25 g/polybag, (T.50) *Trichoderma* sp with a dose of 50 g/polybag; (T.75) *Trichoderma* sp with a dose of 75 g/polybag; (PF.10) *Pseudomonas fluorescens* at a dose of 10 ml/l water, (PF.20) *Pseudomonas fluorescens* at a dose of 20 ml / l of water; (PF.30) *Pseudomonas fluorescens* at a dose of 30 ml / l of water, (G.10) *Gliocladium* sp at a dose of 10 g /polybag; (G.20) *Gliocladium* sp with a dose of 20 g/polybag, and (G.30) *Gliocladium* sp at a dose of 30 g/polybag, (K.1) chemical fungicide, and (K) without fungicide.

A resistance induction in the banana plant seeds during the research is a trait enabling the plants to respond against the pathogen attack under appropriate conditions. A biochemical resilience shown by the increased formation of toxic compounds that inhibit the growth of pathogens (Hammerschmidt & Dann, 2000) cit. Soetanto & Rahayuniati (2009).

A biochemical mechanism of inhibition that occurs in plants does not cause an inhibition of plant growth. It, otherwise, is able to increase the production and the resistance to environmental stress in several plant species (Desmawati, 2006. Cit Soetanto & Rahayuniati, 2009).

## 2. Measurement of Population Density of *Fussarium* and Biological Agents in Soil, and the Colonization of *Fussarium* and Biological Agents in Root Tissues.

The results of measurements of population density of *Fussarium* and biological agents showed that the treatments of *Trichiderma*, *Gliocladium* and *Pseudomonasfluorocens* applied in the *Fussarium* fungi-infected soil fungi were able to grow quite well (Table 3). The lowest total of *Fussarium* population was present in the *Pseudomonas fluoroscens* treatment with a dose of 10 ml/liter of water, i.e.  $2 \times 10^4$ , while the control treatment (no treatment of biological agents and chemical fungicides), the population density is  $4 \times 10^5$ .

Table 3. Treatment Effect of the Specieses of *Trichoderma* ssp, *Gliocladium*, and *Pseudomonasfluorescen* to the Population Density of *Fussarium* and Biological Agents in the Soil Conservation, the Colonization of *Fussarium* and Biological Agents in the Root Tissues of Banana at the Final Observation

No	Code	Population Density (in soil)		Colonization Capacity (in root) %	
		<i>Fussarium</i>	Biological agents	<i>Fussarium</i>	Biological agents
1	(T.25)	$4 \times 10^5$	$1,6 \times 10^6$	-	75
2	(T.50)	$4 \times 10^5$	$2 \times 10^4$	-	100
3	(T.75)	$6 \times 10^5$	$4 \times 10^5$	-	100
4	(PF.10)	$2 \times 10^4$	$6 \times 10^5$	-	100
5	(PF.20)	$1 \times 10^6$	$2,2 \times 10^6$	-	100
6	(PF.30)	$4 \times 10^5$	$4 \times 10^5$	-	100
7	(G.10)	$2,4 \times 10^5$	$4,4 \times 10^5$	-	50
8	(G.20)	$6 \times 10^5$	$1,8 \times 10^6$	-	75
9	(G.30)	$8 \times 10^4$	$4,4 \times 10^5$	-	75
10	(K.1)	$2,6 \times 10^5$	-	50	
11	(K.0)	$4 \times 10^5$	-	100	

Note: (T.25) *Trichoderma* sp at a dose of 25 g/polybag, (T.50) *Trichoderma* sp with a dose of 50 g/polybag; (T.75) *Trichoderma* sp with a dose of 75 g/polybag; (PF.10) *Pseudomonas fluorescens* at a dose of 10 ml/l water, (PF.20) *Pseudomonas fluorescens* at a dose of 20 ml / l of water; (PF.30) *Pseudomonas fluorescens* at a dose of 30 ml / l of water, (G.10) *Gliocladium* sp at a dose of 10 g /polybag; (G.20) *Gliocladium* sp with a dose of 20 g/polybag, and (G.30) *Gliocladium* sp at a dose of 30 g/polybag, (K.1) chemical fungicide, and (K) without fungicide.

The development of biological agents applied in *Fussarium* fungus-infected soil as the planting media showed a pretty good improvement. This is evident from the number of populations of biological agents of *Trichoderma*, *Gliocladium* and *Pseudomonas fluoroscens* the soil at the end of the study. The highest population was found in the medium applied with *Pseudomonas fluoroscens* at the dose of 20 ml/liter of water, i.e.  $2,2 \times 10^6$ . This results indicates the biological agents applied into the planting medium grow quite well and are able to inhibit the attack of *Fussarium* fungi on banana *Mas* seedling root system during the study.

The inhibition of *Fussarium* fungal attack on the system of seedling roots of banana plants also

occur because of the colonization of antagonist biological agents, *Trichoderma*, *Gliocladium* and *Pseudomonas fluoroscens* in the root system of the plant (Table 6). The treatment of biological agents in the first planting medium in the form of sterile sandy soil functions in the formation and the development of biological agents colonies in the root system of plants. In such a condition, despite of the large number of colonies of *Fussarium* in the second medium of planting, there is no infection and attack which may cause a damage to the root system of the plants, tubers and other tissues inside the banana plant seeds until the end of the study.

## 3. Banana Seedlings Vegetative Growth



The results of the data analysis showed that there was a significant difference in the parameters of plant height, stem diameter, number of leaves and number of roots. However, it did not significantly affect the parameters of root length and plant fresh weight at the end of the study. The *Trichoderma* treatment at a dose of 50 g/crop planting hole gives the best results in almost all

plant growth parameters observed, including the plant height of 194.246 cm, a stem diameter of 3.446 cm, the number of roots of 38.333, the root length of 28.99 cm and the fresh plant weight of 1.367 kg. While the control treatment shows a lower vegetative growth than other treatments for some parameters of the observation. More results can be seen in table 4 below.

Table 4. The Effect of Treatment of Biological Agents of *Trichoderma*, *Gliocladium* and *P.fluoroscensto* the Plant Height, Stem Diameter, Number of Leaves, Number of Roots, Length of Roots and the Weight of Fresh Banana Plants at the End of the Study.

Code	Plant Height (cm)	Stem Diameter (cm)	Number of Leaves (piece)	Number of Root (piece)	Lenght of Root (cm)	Weight of Fresh Plant (kg)
(T.25)	181,636 e	3,069 de	5,323 c	33,667 cd	26,99	1.233
(T.50)	194,246 f	3,446 f	5,4 cd	<b>38,333g</b>	28,077	1.367
(T.75)	177,246 d	2,98 d	5,667 e	34,667 d	26,39	1.233
(PF.10)	160,426 bc	2,8 c	4,333 a	33 c	25,693	1.167
(PF.20)	147,12 ab	2,533 b	4,267 a	37,667fg	24,547	1.133
(PF.30)	158,14 bc	2,76 c	5,333 c	28 b	26,347	1.067
(G.10)	179,91 de	3,16 e	5,6 de	28 b	25,517	1.3
(G.20)	181,5 e	3,026 d	4,8 b	36,667 ef	23,797	1.2
(G.30)	172,346 cd	2,986 d	5,733 ef	36 e	25,44	1.233
(K.1)	146,293 a	2,393 a	5,933 f	28,333 b	27,863	0.967
(K.0)	156,96 b	27,8 c	4,8 b	24,333 a	27,863	0.9

Note: (T.25) *Trichoderma* sp at a dose of 25 g/polybag, (T.50) *Trichoderma* sp with a dose of 50 g/polybag; (T.75) *Trichoderma* sp with a dose of 75 g/polybag; (PF.10) *Pseudomonas fluorescens* at a dose of 10 ml/l water, (PF.20) *Pseudomonas fluorescens* at a dose of 20 ml / l of water; (PF.30) *Pseudomonas fluorescens* at a dose of 30 ml / l of water, (G.10) *Gliocladium* sp at a dose of 10 g /polybag; (G.20) *Gliocladium* sp with a dose of 20 g/polybag, and (G.30) *Gliocladium* sp at a dose of 30 g/polybag, (K.1) chemical fungicide, and (K) without fungicide.

**b. The numbers followed by the same letter are not significantly different at 5 % BNT (LSD) test.**

The treatment of biological agents of *Trichoderma*, *Gliocladium* and *P.fluoroscens* was able to increase the growth of the banana plant seeds during the acclimatization. The addition of biological agents of *Trichoderma*, *Gliocladium* and *P.fluoroscens* in the second stage of growing media of soil infected with a *Fussarium* fungus, functioned as the agents of *Fussarium* disease control in the root system of banana plant seeds and also played a role in the decomposition of the organic matters in the soil.

This is consistent with the results of research of Pandriani and Supriati (2010). Their *Trichoderma* treatment on peat soil was able to decompose organic materials in the acidic peat soil into nutrients required for the plant growth, especially the nitrogen elements in the soil. The element of nitrogen which is rich in the goat manure is able to meet the needs of the N elements in the banana plant seedlings in the study, where the

elements of N for the vegetative growth phase is dominantly needed. According to the Linga and Marsono (2001), Nitrogen is essential for the vegetative growth of the plants; it can stimulate the vegetative growth, especially the growth of overall trunk, branches and leaves of the plant. The important role of Nitrogen in the plant growth is absolute and essential due to its role in the biochemical processes of the plants.

In plants, the stem serves as a storage (sink), stockpiles of the photosynthesis. The good process of photosynthesis on the plant will have a positive impact on the increase of the stem diameter, this is due to the better growth of the plant canopy section by the addition of the biological agents of *Trichoderma*, *Gliocladium* and *P.fluoroscens*. Thus, the photosynthesis process in the canopy organs increases and has a direct impact directly on the more photosynthates produced and the better photosynthate distribution to the organs of plants, including to the trunk and stems.

The low growth of the control plant is possibly due to inexistence of factors that trigger the

decomposition of organic matter in the soil such as *Trichoderma* and *Gliocladium* which have the role. The availability of nutrients that can be absorbed by plants is less than those subjected to the addition of biological agents. The findings of Taufik (2010) support the results of the study; a treatment of no addition of *Trichoderma* results in a lower growth as it was evident from the number of branches and the fruit weight, compared to another treatment by adding *Trichoderma*.

Another study conducted by Cook and Baker (1983) also showed that *Trichoderma* sp was able to decompose the organic matter in the soil into nutrients which are easily absorbed by plants. In addition, the organic matter available in the soil becomes the source of nutrients for antagonistic microorganisms. It increases the activity of the antagonist agent, stimulates the pathogen propagule dormancy and produces the fungistatic effects for most soil-borne pathogens.

Meanwhile, in the treatment of *P. Fluoroscens*, that stem diameter growth is not good enough. *P. fluoroscens* produces antibiotics, but it has a siderophore of pseudobactin compound which binds Fe to become a complex compound that is not available to the plants and has impact on the plant growth inhibition.

On the surface plant the width of photosynthesis and the strong root structure are needed in the vegetative growth of the plants. Early vegetative growth of the plant allows the plant to absorb more light energy for photosynthesis as the plant size increases, and it allows the absorption of water and nutrients to support the growth of leaves as the center of photosynthetic reaction (Gardner, 1991).

In this study the role of biological agents, especially *Trichoderma* and *Gliocladium* applied to the medium of banana plant seeds have a positive influence on the improvement of the environmental condition of the soil where plants grow, just like the previous notion that *Trichoderma* is able to decompose organic matter in the soil into nutrients that are easily absorbed by plants. Another similar idea is stated by Affandi et.al (2001) who argue that some of the fungi are associated with the degradation process, in which *Trichoderma* plays a key role in the decomposition of organic compounds, especially in its ability to degrade the compounds which are hard to degrade like lignocellulose.

The improvement of root system and the vegetative growth of the plants which are seen in the growth of the plant height and of the stem diameter at each treatment in this study turned out to influence the increase in the number of leaves produced by the banana plant seeds. The treatment of antagonistic biological agents of *Trichoderma*, *Gliocladium* and *P. Fluoroscens* does not only suppress the wilt pathogen attack of *Fusarium* on the banana plant seeds, but also affects positively to the root growth and development. The colonization of biological agents on the root system does not only inhibit the pathogen attack but also able to increase the number of roots and root elongation, which in turn helps to improve the overall seedling growth which impact on the increase of the fresh plant weight.

## CONCLUSION

From the discussion above it can be concluded as follows :

1. The treatments of the biological agents of *Trichoderma*, *Gliocladium* and *P. fluoroscens* in the study are proven to give effect of the resistance increase of banana seedlings against the *Fusarium* wilt disease, as it is evidenced by the formation of biochemical resistance through the formation of phenolic compounds such as tannins, saponins and glycoside in the plant tissue.
2. The treatment of the biological agents of *Trichoderma*, *Gliocladium* and *P. fluoroscens* applied in the planting medium has an effect on the suppression of *Fusarium* wilt on banana plant seeds, as evidenced by the impresence of the symptoms of the attack on plant seeds until the end of the study. This is caused by the formation of colonization between biological agents with the root system of the plants.
3. The treatment of the biological agents of *Trichoderma*, *Gliocladium* and *P. fluoroscens* applied in the planting medium is proven to provide better growth when compared with no treatment of biological agents (control) in which they give a significant effect on the improvement of the parameters of plant height, of the leaf number, of the stem diameter, and of the number of roots, but they have no significant effect on the parameters of the root length and the fresh plant weight. However, the treatment of *Trichoderma* of 50 g/planting hole shows the best results in almost all parameters observed.

## References

- Azizah N, 2009, Pengimbasan Ketahanan Bibit Pisang Raja Terhadap Penyakit Layu Fusarium dengan Ekstrak Bakteri Antagonis, *Skripsi*, Fakultas Pertanian Universitas Jenderal Soedirman, Purwokerto, 48 hal (Tidak Dipublikasikan).
- Bajaj, Y.P.S, 1983, *Production of Normal Seeda from Plants Regenerated from the Meristem of Arachis hypogaea and Cicer arietinum Cryopreserved for 20 Months*, *Euphica*, 32 : 425-430
- Catriani., Tusi (2010) *Identifikasi Spesies Trichoderma Spp. Dari Sentra Produksi Pisang Di Sumatera Barat Dan Uji Tingkat Kemampuannya Dalam Menekan Perkembangan Fusarium Oryzporum F.Sp.Cubense,Fecara In Vitro*, Other Thesis, Fakultas Pertanian.
- Cicu, 2005. Pengelolaan Penyakit Tular Tanah Melalui Solarisasi. Laporan hasil penelitian Satuan Kerja Pengkajian Teknologi Pertanian Sulawesi Barat.
- Cook, R, J, and K, F, Baker, 1989, The Nature on Practice of Biological Control of Plant Pathogens, ABS press, The American Phytopathological Society, St, Paul, Minesota 539 p.
- Djatmika, I, 1992, *Pengendalian penyakit layu pada pisang dengan cara Biologis*, Prosiding Pisang sebagai Komoditas Andalan, Segunung.
- Direktorat Tan, Buah, 2004, *Rehabilitasi Kebun Pisang Rakyat*, Dirjen Bina Produksi dan Hortikultura, Jakarta.
- Hadisutrisno, B, 1995, *Uji Pertumbuhan dan Kesehatan Tanaman Panili Asal Biji*, Dalam Konggres Nasional VIII dan Seminar Ilmiah PFI, Mataram Hal, 382-386.
- Herlina, L. 2009. Potensi trichoderma harzianum sebagai Biofungisida pada Tanaman Tomat. Biosaintifika. Vol. 1, no. 1. Hal. 62-69.
- Lo, C, -T., Nelson, E, B., and Harman, G, E, 1997, Improved Biocontrol Efficacy of Trichoderma harzianum 1295-22 for Foliar Phases of Turf diseases by Use of Spray Application, *Plan Disease*, Vol, 81, No, 10, pp, 1132-1138.
- Nusret Ozbay and Steven E. Newman, 2004. Biological Control with *Trichoderma* Spp. With Emphasis on *T. harzianum*. *Pakistan Journal of Biological Sciences*, 7: 478-484.
- Priyono, 2000, *Perbanyakan Abaca (Musa textilis Nee) Melalui Kultur Mata Tunas Secara In vitro*, Pelita Perkebunan () 129-133.
- Shofiyani, A, 2003, *Pengaruh Variasi NAA dan BAP terhadap Keberhasilan Kultur Meristem Pisang (Musa paradisiaca c.v. Rajalawe)* Laporan Penelitian DPP-SPP UMP.
- Soesanto L, Rokhlani & Prihatiningsih N, 2008, Penekanan beberapa mikroorganisme antagonis terhadap penyakit layu Fusarium gladiol, *Agrivita* 30(1): 75-83.
- Soesanto L, 2008, *Pengantar Pengendalian Hayati Penyakit Tanaman*, PT Raja Grafindo Sukanto, D, Wahyuno, A, Rahmat, D, Sitepu dan S, Mogi, 1995, *Pengaruh agensia nabati cengkeh terhadap penyakit busuk batang dan pertumbuhan panili*, Strengthening Researce on Disies of Industrial Crop in Indonesia JICA- BALITTRO, Annual Report 3 : 1 – 20.
- Sunarjono, H, 2004, *Budidaya Pisang Dengan Bibit Kultur Jaringan*, Penebar Swadaya, Jakarta, 96 h.
- Tombe, M, A, Nurawan dan Sukanto, 1993, *Penelitian Penggunaan daun cengkeh dalam pengendalian penyakit busuk batang panili*, Pros, Seminar hasil Penelitian dalam Rangka emanafaatan Pestisida Nabati : h, 28 – 36
- Widyastuti, S, M., Sumardi, A, Sulthoni, dan Harjono, 1998, Pengendalian Hayati Penyakit Akar Merah pada Akasia dengan Trichoderma, *Jurnal Perlindungan Tanaman Indonesia*, Vol, 4, No, 2, hal, 65-72.
- Widyastuti, S, M., Sumardi dan Harjono, 1999, Potensi Antagonistik Tiga Trichoderma spp Terhadap Delapan Penyakit Akar Tanaman Kehutanan, *Bulletin Kehutanan* No, 41, Fakultas Kehutanan – UGM, Yogyakarta, Indonesia, Hal, 2-10.

**SERVICES CAPACITY OF ISLAMIC FINANCIAL SERVICES COOPERATIVE IN  
THE DEVELOPMENT OF SMALL AND MEDIUM ENTERPRISES (SMEs) IN  
PURWOREJO CENTRAL JAVA INDONESIA**  
(Analysis of Services Quality Effect to Loyalty with Satisfaction as an intervening variable in  
Business Partner of Islamic Financial Services Cooperative In District Purworejo)

**Agus Fitri Yanto, Danis Imam Bachtiar and Agus Dwi Atmoko,  
Polytechnic Sawunggalih Aji - Purworejo  
agusfy@polsa.ac.id**

**ABSTRACT**

*Value added sub sectors Non-Bank Financial Institutions (KSP, KJKS, etc.) and Support Services for Purworejo (BPS Purworejo, 2011) on 2009 of 22.521.350.000,00 IDR While in the year 2010 increased 10.7 % to 24.933.380.000 00 IDR or 14.2 % of the value -added banking. Looking at the condition, KJKS has provided support to the economy Purworejo. Although KJKS not banking institutions, KJKS still expected to increase professionalism in customer service by focusing on reliability, responsiveness, assurance, empathy and tangible. Quality services can provide satisfaction and improve loyalty members. KJKS will increase the carrying capacity of SMEs, the economy and public welfare of Purworejo. The issues raised is how the influence of service quality on satisfaction and loyalty in KJKS members. The purpose of research is to determine the effect of service quality or the quality of service that consists of reliability, responsiveness, assurance, empathy and tangibles on satisfaction and loyalty in Purworejo KJKS members. The survey results revealed that service quality significantly influence satisfaction and loyalty in Purworejo KJKS members. Results of analysis of the effect (direct and indirect effects) indicates that the direct path tangible and assurance the most dominant and significant positive effect on loyalty members. Therefore to improve the quality of service, KJKS can move on increasing the capacity of the physical facility / non-physical, employee capabilities, appearance and attitude of the employees as well as providing a sense of comfort and security guarantees to members.*

**Keywords :** KJKS, loyalty, quality of service, satisfaction.

**BACKGROUND**

Until the year 2010, the performance of the national economy continued to show a positive direction. As the data of Gross Regional Domestic Product (GRDP) in Purworejo (BPS Purworejo, 2011), economic growth reached 5.01 percent in 2010. The performance impact on the positif regional economy, including for Purworejo. Average economic growth Purworejo in 2006 - 2010 amounted to 5.38%, while in 2010 reached 5.01%.

Economic growth of Purworejo 9.67% supported by manufacturing sector and 19.66% from service sector. Improved support services sector related to rising capita income as an indicator of the success of economic development. Purworejo capita income in 2010 amounted 8.392.539,03 IDR, that up to 10.70% from 2009 (BPS Purworejo, 2011). Subsectors value added from Bank Financial Institution and Supporting Services in 2009 amounted 22.521.350.000,00 IDR. In 2010 increased to 24.933.380.000,00 IDR (10.7 %). Non Bank Financial Institution (LKBB – in Indonesian language) added value reached 14.20 % of the value -added banking, which includes among other Credit Unions (KSP - in Indonesian language) and the Islamic Financial Services Cooperatives (KJKS - in Indonesian language).

Looking at the condition, KJKS has lent support to the Purworejo's economy. They compete with other LKBB like KSP and 12 banking institutions in Purworejo. Affairs to market products and get these members must be managed well thus increasing the carrying capacity for economic growth and development of SMEs and in particular for public welfare Purworejo.

Excellence competitively in a tight competition, one of which sought to high quality services that generate customer satisfaction. Quality

of services can be measured with a servqual (service quality) model by Parasuraman (1988). Consumer perceptions of servqual resulting from the comparison between the expectations of the service received and with the actual service experience (Azleen & Berry, 2008). According to Parasuraman, et.al (1988) there are five dimensions of service quality as customers expectations component that is tangible, reliability, responsiveness, assurance and empathy. The five aspects can improve competitive advantage in consumer expectations in an environment steeped in competition, community, interpretative and comprehensive competitors.

Consumer satisfaction is understood as a feeling of pleasure or disappointment after comparing the performance of the products considered against expected results (Kotler, 2007:177). Therefore, the the higher quality of service will increase customer satisfaction. But satisfaction is not the final goal of marketing, because there is customer loyalty on the next stage. According to Kotler (2007:542), loyal customer will give benefits for the companies because they are less sensitive to price, positive attitudes toward the product, purchase products for a long period and disseminate positive information about the company or its products. Development of service quality can produce optimal satisfaction to build customer loyalty.

Based on that, KJKS in Purworejo also faced with the challenge of competition or more specifically marketing related services to consumers. Although not a banking institution, KJKS still required to increase the professionalism of the service that is expected to give satisfaction to strategically improve member loyalty and no longer just an alternative. Additionally KJKS growth can increase the carrying capacity of the Purworejo's economy and welfare of society in general.

The problem is how to influence the quality of service that consists of reliability, responsiveness, assurance, empathy and tangibles on satisfaction and loyalty as well as the effect of satisfaction on loyalty in Purworejo KJKS members. This study is limited only related to business partners (members) of five KJKS on deposit and financing products. In order to determine the effect of service quality

(reliability, responsiveness, assurance, empathy and tangibles) to the satisfaction and loyalty as well as the effect of satisfaction on loyalty Purworejo KJKS members.

## **METHOD**

### **Time and Place Research**

The research was conducted on September-November 2013 in Purworejo. Object of research are KJKS members that consists of : (1) BMT KJKS As Shaff - Tanjunganom street Kutoarjo Purworejo; (2) BMT KJKS AN Nur - S. Parman street 19C Kutoarjo Purworejo; (3) BMT KJKS Binamas - Urip Sumoharjo Street 80 Purworejo; (4) KJKS BMT Nuurul Waahid – Krandengan Village Bayan Purworejo; (5) KJKS BMT Taawun - Urip Soemoharjo Street Purworejo.

### **Data Analysis Techniques**

This study uses several analytical tools. First, descriptive analysis, the descriptive details of the service users in Purworejo KJKS with an overview of the sexes among other things, jobs, the economy and education. Second, the validity of the test indicates the extent to which the precision and accuracy of a measuring instrument in carrying out the function of its size. To test the validity of the technique used product moment correlation (Sugiyono, 2008:101). A questionnaire items as valid if the value of  $r$  obtained from the calculation results (product moment ) is greater than the table value of  $r$  ( $r$  results  $>$   $r$  table) or if the value of the correlation coefficient over 0.3.

Third, reliability test, conducted to determine the extent to which a measuring instrument reliable and consistent when measured two times or more of the same symptoms with the same measuring instrument. Testing was done by using Alpha Cronbach's ( Supranto , 2001:160) .

When approaching the value of 0.8 means koefisien grains in question coefficients more reliable. When the alpha value between 0.8 to 1.0 considered good and less than 0.6 less well categorized.

Next is a multiple regression analysis to measure the effect of the independent variables are five components of quality of service ( $X_1$ ,  $X_2$ ,  $X_3$ ,  $X_4$  and  $X_5$ ) customer loyalty ( $Y$ ) with KJKS members satisfaction ( $Z$ ) in Purworejo as an

intervening variable . To test the role of the consumer as a mediating variable in the influence of service quality on loyalty using "Path Analysis" as an extension of regression analysis. To maintain the accuracy of the results of the analysis of this research data processing using the 5% significance level .

## RESULT AND DISCUSSION

### Overview of Object Research

The research object are the Business Partner (Member) KJKS in Purworejo. Based on the questionnaire of 350 KJKS Members, 56.29% of respondents were female and 43.71% are male. Majority of respondents aged between 26-45 years (60.29%). Only 24.57% of respondents over the age of 46 years.

While based on educational background, KJKS members who responded to as many as 50.86% of high school graduates. 81.43% of respondents also known educational background in elementary to high school graduates. From the aspect of the work is also seen if dominated by the self-employed / entrepreneurs (38.86%). Only 4.86% proportion of civil servants who have farmer, (10.00%) as well as military / police (0.86%). The majority of members on middle to lower economic with 51.43% income up to 1.000.000,00 IDR and 84.29% earn up to 2.500.000,00 IDR.

A total of 48.29% of the product was already using the KJKS service more than three years. While 24.29% of the members are new members of the old no more than one year. A total 75.71% of respondents had an advanced member of more than one year. Aspects loyalty members also high, where they use the service and not be a member of another KJKS (77.71%). Only 19.14% are also members in other KJKS. The main services are used predominantly members for deposit products (51.14%). Financing products as the main product only used by 42.29% of the members. Patronage to KJKS also evident from the many members who currently did not use the bank's services as much as 67.42% and 32.57% is also a bank customer.

### Test Validity and Reliability

This study focuses on the analysis of service quality effect on KJKS members loyalty. The variables involved in it : reliability (X1), responsiveness (X2), assurance (X3), empathy (X4), tangible (X5), satisfaction (Z) and loyalty (Y). The analysis model used to solve the problem is the quantitative analysis. Validity test is known that all the items declared valid question. Reliability test results also showed that all statements regarding the reliability (X1), responsiveness (X2), assurance (X3), empathy (X4), tangible (X5), satisfaction (Z) and loyalty (Y) has a reliable condition. It mean, questionnaire study were able to give an idea that all reliable or powerful items that can be used as a research instrument.

### Path Analysis

From the test results of determination equation 1, it can be seen the amount =  $(1-R^2) = (1-0,753) = 0.247$  or 24.7% (mass value towards satisfaction arrows).  $R^2$  shows the test results of 0.753 (75.3%) which means that the variability of the dependent variable that can be explained by the independent variables was 75.3%. While the rest (24.7%) is explained by other variables outside the regression model. Variants for (magnitude values arrows towards customer loyalty) based test of determination equation 2, it can be seen the amount =  $(1-R^2) = (1-0,386) = 0.614$  or 61.4%.  $R^2$  on the test results obtained by 0.386 or 38.6% which means that the variability of the dependent variable that can be explained by the variability of the independent variable and the remaining 38.6% (61.4%) is explained by other variables outside the regression model.

While the F test equation 1 (#1 Table), Anova table shows the value of  $F = 209.916$  with a significance value  $0.000 < 0.05$ . Taken together independent variable reliability, responsiveness, assurance, empathy and tangible influence KJKS members satisfaction in Purworejo. From equation 2 ANOVA table (#2 Table) are known the value of  $F = 35.921$  with a significance value  $0.000 < 0.05$ . So that is jointly independent variable reliability, responsiveness, assurance, empathy, tangible and satisfaction affect Loyalty.

At the significance level = 5 %, all variables (reliability, responsiveness, assurance, empathy and

tangible) shows the positive correlation (effect) to the members satisfaction (#3 Table). It can be seen from the significant value of each variable  $< 0.05$ . But variable of responsiveness, empathy and satisfaction is not correlated positive to member loyalty. Meanwhile, Reliability, Assurance and Tangible positively correlated to members Loyalty.

Based on analysis of the effect (direct effect and indirect effect) indicates the most direct path tangible and significant positive effect on loyalty members that the regression coefficients (the dominant influence) of 0.282 which is greater than the other lanes and have a strong relationship at 0.533 (#1 Figure). Therefore, in this path analysis, efforts to increase consumer loyalty can be done through the tangible dimension (physical evidence).

Other dominant influence in a positive way is a direct path assurance dimension of 0.204 larger than the two other lines and have a relationship / strong correlation of 0.532. In this dimension, among others, the ability to provide security and a sense of comfort and trust given to members. the consistency of a good attitude and friendly employees and the ability of employees to respond to questions and other matters concerning KJKS.

These results are the same as with V. Shankar, et.al (2004) that customer satisfaction mediates the relationship between customer value and loyalty significantly. Satisfaction significantly positive effect on customer loyalty. Likewise with Azleen Illias et.al (2008) which revealed a significant positive relationship between the dimensions servqual partially or jointly to customer satisfaction.

## CONCLUSION

With the dominance correlation or directly influence of Tangible and Assurance to KJKS members loyalty, for Tangible aspects (tangible evidence / physical), pathway analysis indicated that efforts to improve the appearance of physical facilities, equipment, employees, communication materials, infrastructure capabilities and state of the environment, will have a significant influence for increasing member loyalty. Technically to increase member loyalty KJKS among others, can be done by providing an office building with a comfortable and adequate physical facilities (equipment,

supplies, etc.) are neat and clean. Pamphlets / brochures / media information should be available with both, complete, up to date as well as the appearance of the employees were pleasant enough.

Through the assurance, improving the quality of services can be performed by an increase in the ability to provide a sense of assurance comfortable, confident and secure in members. The employees ability to be good (consistently friendly) and their ability to answer any questions members should also be prioritized. If the assurance components are continuously enhanced to give effect to the increase loyalty KJKS members. Consumers are increasingly feeling confident and believe that their KJKS choice is a qualified institution and the interests of its members.

This is certainly in line with the objectives of the establishment KJKS (Permeneg. KUKM No. 35.2 in 2007): (1) Enhance economic empowerment, particularly among Micro, small and medium-sized cooperatives through the Islamic system, (2) Promoting economic life sharia in action micro, small and medium enterprises in particular and Indonesia in general economic and (3) Enhance the spirit and participation of community members in the Sharia Financial Services Cooperative.

## REFERENCES

- Azleen, et. al. 2008. *Service Quality and Student Satisfaction : A Case Study at private Higher Education Institutions*. International Business Research Journal. Vol.1 No. 3 p. 163. CCSE.
- Kotler, Philip & Keller, Kevin. 2007. *Manajemen Pemasaran*. Jakarta. Indeks.
- Parasuraman, A. Valerie, A. Zeithaml, & L. Berry. 1988. *The Service Quality Puzzle. Journal of Marketing Business Horizon, Vol.49 (Fall), p.44*.
- Sugiyono. 2008. *Metode Penelitian Bisnis*. Bandung : Alfabeta.
- Supranto, J. 2001. *Statistik*. Jakarta. Erlangga
- Venkatesh, et. al. 2004. *Customer Value, Sstisfaction, Loyalty and Swiching Cost: An Illustration from a Business-to-Business Service Context*. Journal of The Academy of Marketing Science Vol. 32 No. 3, pages 293-311.

Proceedings National Olympiad and International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, 28<sup>th</sup> December 2013

- \_\_\_\_\_. 2011. Produk Domestik Regional  
Bruto (PDRB) Kabupaten Purworejo Tahun  
2010. BPS Purworejo.
- \_\_\_\_\_. Standar Operasional Manajemen (SOM)  
Kelembagaan KJKS dan UJKS Koperasi.  
Peraturan Menteri Negara KUKM Republik  
Indonesia No. 35.2/Per/M.KUKM/X Tahun  
2007.



**TABLE AND PICTURE** (Sources: Primary data processed, November 2013)

**#1 Table - The FEQuation1**

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1111,243	5	222,249	209,916	,000 <sup>b</sup>
	Residual	364,211	344	1,059		
	Total	1475,454	349			

a. Dependent Variable: Satisfaction

b. Predictors: (Constant), Tangible, Reliability, Emphaty, Assurance, Responsiveness

**#2 Table - The FEQuation2**

**ANOVA<sup>a</sup>**

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	540,475	6	90,079	35,921	,000 <sup>b</sup>
	Residual	860,142	343	2,508		
	Total	1400,617	349			

a. Dependent Variable: Loyalty

b. Predictors: (Constant), Satisfaction, Reliability, Tangible, Emphaty, Assurance, Responsiveness

**#3 Table - CoefficientRegressionEquation1**

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	-,224	,538		-,416	,678
	Reliability	,134	,038	,136	3,532	,000
	Responsiveness	,296	,045	,300	6,601	,000
	Assurance	,162	,050	,146	3,249	,001
	Emphaty	,197	,038	,213	5,214	,000
	Tangible	,223	,036	,233	6,371	,000

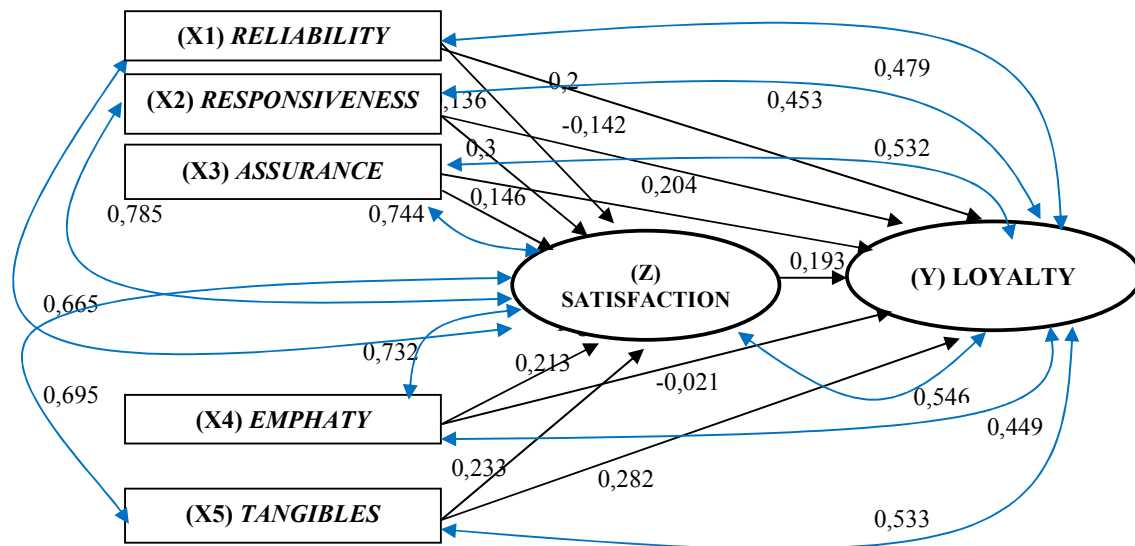
a. Dependent Variable: Satisfaction

**#4 Table -CoefficientRegressionEquation2**

**Coefficients<sup>a</sup>**

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	4,380	,828		5,288	,000
	Reliability	,192	,060	,200	3,227	,001
	Responsiveness	-,136	,073	-,142	-1,863	,063
	Assurance	,219	,078	,204	2,818	,005
	Emphaty	-,019	,060	-,021	-,309	,757
	Tangible	,263	,057	,282	4,622	,000
	Satisfaction	,188	,083	,193	2,261	,024

a. Dependent Variable: Loyalty



#1 Picture – Path Analysis Result

## THE ROLE OF SMALL AND MEDIUM ENTERPRISES ( SMEs ) TO COMMUNITY BUSINESS DEVELOPMENT IN INDONESIA ( A Study of Productive Economic Activities in Kalimantan )

**R. Deni Muhammad Danial<sup>1</sup> and Heinrich Gultom<sup>2</sup>**

<sup>1</sup>Student of Doctoral Program of Business Administration UNPAD

Lecturer of Business Administration, Muhammadiyah University of Sukabumi ( UMMI )

<sup>2</sup>PNPM Support Facility - World Bank

### **ABSTRACT**

*This paper is a result of research in Kalimantan about the community business development. Research conducted in the period from January to March 2013, is sponsored by PNPM Support Facility - World Bank . The results shows that SMEs are very important to grow the community business in order to alleviate poverty . But the government has not supported optimal. To optimize government support for SMEs, it is necessary to support real synergy between the development of economic infrastructure, education and training in business management and the provision of access to funds for the implementation of the community business through SMEs .*

**Keywords:** *Small and Medium Enterprises, Community Business Development*

### **INTRODUCTION**

Economic history has to be revisited to review the role of small and medium scale enterprises (SMEs). There are hypothesis about it. First, rapidity of economic growth, as happened in Japan, has been associated with the amount of small and medium-sized business sector. Second, the job creation in the United States since second World War, the contribution of SMEs can not be ignored (Birch, 1979).

Developing countries began to change its orientation when viewing experience in industrialized countries about the role and contribution of SMEs to economic growth. Small and medium scale enterprises in developing countries, especially in Indonesia, are the subject of discussion and concerned by the government because the small and medium enterprises spread everywhere, and can provide potential employment opportunities. Economists have realized that the small and medium enterprises in particular industrial sector are as one of the characteristics of success and economic growth. Small and medium industries contribute to the construction of various ways, such as: creating job opportunities for the

expansion of the labor force for urbanization and the need to provide flexibility and innovation in the economy as a whole.

The data says that more than 99% of the number of industrial units are small and medium industries. Other data informs that the number of workers are absorbed greater by small and medium industries (67%) compared to the amount of laborabsorbed by large -scale industry (33%). Therefore, it is appropriate that the government gives special attention to economic development (BPS, 2012).

Indonesia has experienced a crisis in 1997 and connected to the next crisis in 2008. The crisis has also resulted in changing standing position of economic sector players. Great Enterprises were bankrupt one by one because of the price of imported raw material increased dramatically, the debt-installment costs increased as a result of the rupiah exchange rate to the dollar was declining and fluctuating. The banking sector also collapsed and contributed reduction of capital in the industrial sector. Many companies are no longer able to continue business due to high interest rates. In contrast to SMEs, they could persist even their number increased.

Nevertheless, the development of SMEs still face many problems that need attention from various parties, among others (Riyadi, 2001): Low productivity, human resources and management are not professional yet, less responsive to the changes in technology and the lack of capital, the access of market is inadequate.

### **METHODS**

The research used qualitative method. The research was done through observation to the PNPM (National Program for Community Empowerment), especially community Productive Economic Business program (UEP) and program of Savings and Loans specified for Women (SPP). In this study therewere three approaches used, they were: (1) document analysis, (2) Interviews with key informants, and (3) Field study. The method used for primary data collection from stakeholders

in the villages visited were Focus Group Discussion. The study was conducted in four provinces (West Kalimantan, Central Kalimantan, East Kalimantan, including North Kalimantan), 9 districts, 12 sub-districts, and more than 17 villages. The study was conducted from January to March 2013.

## RESULTS AND DISCUSSION

SMEs are indispensable in any country to shore up the economy of a country. Veskaisri et al. (2007) stated in his study of SMEs in Thailand that the world needs SMEs. Because of the high importance of SMEs, the State must defend it through economic policy. In Indonesia, the SMEs that including in business community is governed by law. Many of the programs conducted by the government to support the existence of SMEs, one of them is the PNPM program which has productive economic activities to improve the welfare of the community through business development efforts. However, the optimization of government support should be increased.

Businesses run by people of Indonesia, especially in Kalimantan, has 3 characters, namely: common business groups (eg, in the village of Seberang Kapuas, sub-district of Sekadau Hilir, district of Sekadau, the motorcycle washing services business), independent businesses with similar business types (eg, in the village of Lintah Betung, sub-district of Menyuke, district of Landak, the vegetable of mustard business), and independent businesses with different business types (eg, in the village of Kompas Raya, sub-district Pinoh Utara, district of Melawi).

Awareness of villagers in Kalimantan has high enough to open a business. They use borrowed funds from PNPM to conduct their business either individually or in groups. However there are some constraints, for example, difficulty in marketing the product. One of the constraints are condition of road, for example in Lintah Betung village, distance of 25 km must be reached in 10 hours. Another difficulty is the lack of capacity building, especially in the marketing and production management in particular. Capacity building done by facilitators to conduct a business training is not optimal. An owner of SME that has produced cake of Semprong and has taken PNPM fund named Yustina states:

*“Actually, we want to develop the other business beside the business being run now. God willing, we are able to open another business here without leaving the previous business. The women here really want to have the training to make mats. The ingredients are many enough here. Here the cane is quite available, but the mats can also be made from straw.”*

In each village visited, so many potentials of the village and unexploited optimally. Village government and also the facilitators can not see the local potentials that so abundant. And with the potentials, there are opportunities to improve the welfare of the community. In Kalimantan, especially in the border area with Malaysia, too many foreign products sold there especially products of Malaysia. Though the raw materials for the products made in Malaysia is derived from Kalimantan. The community is lacking to utilize the local potential. There are some people who can take advantage of the local potential, but there are several obstacles that must receive attention, they are: the road to transport natural results does not support and creating high production costs, and the people tend to sell the raw materials they produce, the materials are not manufactured to be finished goods but sold to Malaysia.

In this case the role of the government is not optimal in supporting the economic development of society. Community walks alone without guidance. Local governments are living on the PNPM program as a program of the central government. Though, funding from the PNPM program was also lacking. This is as one of the owner of SME in the industry of tofu who says :

*“Thank God, I was able to develop a business of tofu since 2010 with makeshift tools. In 2011 I borrowed money from PNPM three million , but not enough for business development. Yes we 've borrowed neighbor KTP (identity card) from 4 people to get funds 15 million. Alhamdulillah I can.”*

From the above results , the authors try to make a recommendation as follows :

The physical condition, especially roads, is very important for the community to their economic development. Facilities and infrastructure, especially roads that connect nature products to the market, should be supported. This infrastructure development should take precedence.

Facilitators of PNPM should be able to explore the economic potentials of a village. The potentials shall be included in the Plan for Village Development (RPJMDes), and shall be disseminated to the public. In other words, the facilitators should be more observant and more optimal to assist people in exploring the potentials of the village. The potentials should be used and explored to improve the welfare of the community. The facilitators should concern with the management of micro finance as a micro business management as well as possible. In order to explore the potentials of rural economy, the facilitators should coordinate with the local government. Instead, local governments should

support PNPM activities as a whole.

There should be a synergy between the economic development of the PNPM program in education, health, infrastructure, capacity building for productive economic activities of society. Seen in the image below :

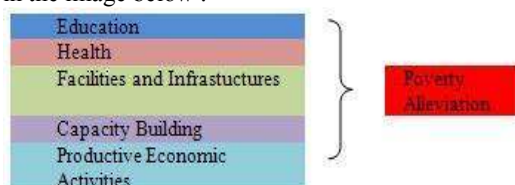


Figure 1. Economic Synergy for poverty alleviation

Training and mentoring of business practices for capacity building program should be held up for the community to become asuccessful entrepreneurs. To make the business really well, should be made a business plan that provides a description of the analysis of strengths, weaknesses, opportunities (market needs, market expansion) and challenges, as well as the prediction of income and expenditure, cash flow and profits. Business planning is very important for SMEs in order to increase competitive advantage (Powell, 1992; Cheng and Yeh, 2007) and to improve corporate performance (Schmidt, 2010).

Enterprises should not be aimed solely to profit oriented but aimed to customer oriented. Economic principle “with the smallest cost to benefit as much as possible” is not popular and not relevant again. Consumers should be the focus of attention. Treat the consumers/customers with low prices or discount facilities. In this case, The most important is business continuity by creating customer loyalty.

The government should be more active in poverty alleviation. The task of the government in economic development is to explore the potentials of local community, to socialize the local potentials, to train people from how to prepare a business plan to be succesfull entrepreneurs, to provide working capital if necessary, to build infrastructure to support the economic development of the community, tocollect CSR (Corporate Social responsibility) program to big companies in Kalimantan.

## CLOSING

The existence of SMEs in the midst of society can not be dismissed. Both in developed countries and in developing countries, SMEs are absolutely necessary. SMEs have become the last helper for state in the economy when there is a severe economic crisis. Naturally, even in developed

countries, SMEs are really protected and supported through a variety of regulations.

Not inferior to the developed countries, the SMEs of Indonesia set this case in a variety of regulations. The Regulations are of course part of the government support for SMEs existence. But unfortunately, the government has not been optimized to support the existence of SMEs. It appears from the results of research in Kalimantan associated with the business community through the development of the role of SMEs.

To optimize the role of government in maintaining even developing SMEs in Indonesia, the strong synergy is absolutely required without separating each other. The Synergy in question is a major economic synergy consisting of: economic infrastructures and facilities development such as roads, bridges and so on; capacity building to enhance the ability of the community business, such as education and management training, as well as the provision of funds and the access to adequate funding for the implementation of the community business development. The Synergy is seen in the image below:



Figure 2. Economic Main Synergy

## REFERENCES

- Birch, D. L. 1979. “The Job Generation Process”. US Department of Commerce: MIT Programme on Neighbourhood and Regional Change reprinted in *Small Business: Critical Perspectives on Business and Management*. 2000. Edited by D. J. Storey. London: Routledge.
- Riyadi, I.B. 2001. *Perijinan dan Sertifikat Industri Kecil dan Menengah*. Yogyakarta.
- Badan Pusat Statistik, 2012.

- Veskaisri, Kitprem, and Chan, Peng and Pollard, Dennis. 2007. "Relationship Between Strategic Planning and SME Success: Empirical Evidence from Thailand". *International DSI/ Asia and Pacific DSI Full Paper* (July).
- Powell, Thomas C. 1992. "Strategic Planning as Competitive Advantage". *Strategic Management Journal*. Vol. 13 No. 7 (Oct.): pp. 551-558.
- Schmidt, Anders McIlquham. 2010. "Strategic planning and corporate performance: What is the relationship?". *Working Paper*, Denmark: Department of Management, Aarhus School of Business at Aarhus University.
- Cheng, Yung-Hsiang, and Yeh, Chian-Yu. 2007. Core Competencies And Sustainable Competitive Advantage In Air-Cargo Forwarding: Evidence From Taiwan. *Transportation Journal* (June).

## CORRELATION BETWEEN INTENSITY OF PLAYING ONLINE GAME AND EMOTIONAL INTELLIGENCE

**Ulfi Kholidiyah dan Susatyo Yuwono**

Psychology Department of Muhammadiyah University of Surakarta

Jl A Yani Tromol Pos 1 Pabelan, Kartasura 57102

Telp 0271-717417 HP 085228010005

Email: sy240@ums.ac.id

### ABSTRACT

*Emotional intelligence has been greatly needed in dealing with others. However, more and more problems facing an individual and they can adversely impact his or her emotional intelligence. One of the factors affecting emotional intelligence is intensity of playing online games. The main purpose of the research was to determine relationship between intensity of playing online games and emotional intelligence. The study proposes a hypothesis that there is a negative correlation between intensity of playing online games and emotional intelligence.*

*Subject of the research is students of SMP A and SMP B in Kartasura who play online games. Sample is taken by using purposive non-random sampling technique. Data was collected by 2 questionnaires : (1) intensity of playing online game, and (2) emotional intelligence, and be analyzed by product moment technique.*

*Results of the research showed a significant correlation between intensity of playing online games and emotional intelligence. The intensity of playing online games of the adolescents was categorized as moderate, while emotional intelligence of the adolescents was categorized as high. The intensity of playing online games affects emotional intelligence at 3.6%.*

**Keywords:** *Intensity of playing online games, Emotional Intelligence*

### INTRODUCTION

Everything done by a human being is inseparable from emotion, because of the emotion presence a human being can express his/her existence in dealing with personal and social problems. This is in accordance Sitorus's opinion (2003) saying that emotion is useful as "a safety valve". Expression of emotion is used to find a balance between comfortable tension and discomfort one, as well as to express desire as a replacement of a success.

Emotional intelligence is needed in dealing with others. Steiner (1997) described that emotional intelligence is an ability to understand one's emotion and others', as well as to know how one's emotions is expressed in order to increase the maximum ethical as a personal power.

Suharsono (2003) suggested that essence of the importance of emotional intelligence for adolescents is as a tool for self-control so that the individual would not fall into actions that could harm him/her or others. Second, emotional intelligence can be implemented as an excellent way to communicate or to raise ideas, concepts or even products. Third, emotional intelligence is an essential capital to develop their talent, especially leadership talent in any field.

The still-happened fact indicates that adolescents are usually having low emotional intelligence. It is revealed in the phenomenon of increased number of teenagers involved in drug abuse, crime, and violence, and more adolescents with depression, having trouble eating, unwanted pregnancy incidents, delinquency and school dropouts (Acbenbach Thomas, a psychologist of Vermont University in Goleman, 2001).

Results of several surveys indicated that emotional slump among adolescents seen in the severity of specific problems such as the following (Goleman, 2000):

- a. Withdrawn, preferring to be alone, being furtive, looks glum frequently, lackluster, unhappy, and too dependent
- b. Anxiety and depression, solitude, fearful and anxious frequently, want to be perfect, feel unloved, nervous and sad easily. It was estimated that 20% of world population suffered from anxiety (Gail in Widosari 2010) and as many as 47.7% of adolescents often feel anxious (Haryadi, in Widosari 2010).
- c. Having attention and thought problems, not able to focus and sit still, often daydreaming, acting without thinking, being too tense to concentrate.
- d. Delinquent and aggressive: hanging out with troubled children, lie or deceive, quarrel frequently, be rude to others, demanding

attention, damage property of others, indiscipline at school and at home, and stubborn and mood changes frequently. In 2006, cases of juvenile delinquency had percentage of 53.52%. It was highest compared to other criminal cases. Problems arising among adolescent is not only felt by them, but also by parents and other people around them (Hasman, 2009).

Problems of adolescent's emotional intelligence can also be seen from their less polite attitude to their teachers, their less focus on learning, making truant only to play online games, and not complete homework. It was also found that some students often lie to their parents to play online games and they were not able to manage their time well.

According to Goleman (2007), one of the factors affecting emotional intelligence is non-family factors such as intensity of playing online games. Adolescents have a tendency to follow trend and be easily influenced by the environment (Nissa, 2003).

Easy access to an online game with exciting facilities it offers as well as influence of friends will make adolescents more interested in playing online games. According to Yee (Ariadne, 2001), it was mentioned that 64.45% boys and 47.85% girls with range of age was 12-22 years old playing online games said that they considered themselves addicted to the online game; and 25.3% of adolescents male and 19.25% female adolescents with range of age was 12-22 years old playing online games were trying to quit but not successful.

Technological development also makes some adolescents lose their interests in learning and unconcerned with friends around them. When adolescents are already playing online games, then it is not rare thing that the initially active learners may become lazy ones, aggressive and having habit of unrestrained speaking, even chided. Of course, these will negatively impact their mental development. They loss concern with his/her friends and surrounding environment, they even become easier to hurt their peer or younger siblings (Musbikin, 2009).

Based on the description above, author can formulate a problem statement based on the existing theories, namely "Is there any correlation between intensity of playing online games and adolescent emotional intelligence?"

## LITERATURE REVIEW

Goleman (2001) stated that emotional intelligence is a particular ability of a person in self-motivating, resilience in the face of failure, control emotions and satisfaction, as well as set the mood. Howes and Herald (in Stein & Book, 2002)

said that emotional intelligence is basically, a component making an individual to be smart in using emotion.

Furthermore, Stein and Book (2002) defined emotional intelligence as a set of skills allowing us to pave the way in a complicated world – aspects of personal, social, and defense of all intelligence, full mysterious common sense, and sensitivity that is necessary to function effectively every day.

Then, Sternberg and Salovey (2008) suggested that emotional intelligence is an ability to recognize emotion of self, which is a person's ability to recognize his/her own feelings as the feeling or emotion arises, and he/she was able to recognize his own emotions when he/she has a high sensitivity over their true feelings and then makes decisions steadily.

Goleman (2007) explained that the factors which affecting emotional intelligence are:

- a. Family environment is the first school to learn emotion.
- b. Non-family environment is related to the school environment and community, peers and everyday activities such as playing online games.

Goleman (2000) revealed five (5) areas of emotional intelligence :

- a. Recognizing one's emotions: self-awareness in recognizing why the feeling occurs is the basis of emotional intelligence.
- b. Managing emotion: managing emotion means dealing with feeling in order to reveal it appropriately.
- c. Motivate oneself: to set emotions as a means to achieve goal is very important in relation to pay attention, motivate oneself and control oneself, and to be creative.
- d. Recognizing others' emotions: empathy or recognize other people's emotions is built based on emotional self-awareness, an associate skills.
- e. Fostering relationships with others: a skill that is supports popularity, leadership, and interpersonal success.

Sax (in Anwar 2010) stated that intensity is the depth or strength of an attitude towards something is not necessarily similar although the direction may be similar. According to Chaplin (1999), the intensity is a quantitative character of a simulation that is related to the simulation intensity.

According to the Indonesian Dictionary (2002), word 'play' is to do something for fun. While 'online game' means a game accessible by many players, where the machines used by players is connected to each other by internet (Adams & Rollings, 2007). Author concluded that the intensity of playing online game is how often or frequency of an individual playing online game.



According to Horrigan (2002), the intensity consists of two aspects, namely:

- a. *Frequency aspect*. The frequency aspect refers to the frequency or how often the subject played online game.
- b. *Duration of access*. This aspect has a significant importance because it explains how much time had been used to play the online game.

Kaloh (in Bintarti, 1997) stated that intensity of a person's activity has a close relationship with his/her feeling. Feeling excited to activities to be carried out will encourage an individual's interest to perform the activities. Monks et al (1999) suggested that adolescence lasts between 12-21 years old with division as follow: early adolescence (12 to 15 years old), middle adolescence (15 to 18 years old), late adolescence (18 to 21 years old). The adolescence is known as storm and stress period, namely emotional upheaval with rapid physical growth and varied psychological growth.

Considering that adolescence is a period of unstable psychological condition and easily influenced by the environment and peers, thus an adolescent should have and understand what an emotional intelligence is in order to avoid the negative things that can harm himself and others (Fatimah, 2006).

According to Mcloyd, et al (in Santrock, 2011), adolescents who live today are facing various lifestyle choices through media. Adolescents play online games for fun and a pleasant activity that is differ from daily life business, they use online games to obtain information, to find more sensation than adults because the online game provides a new and continuous stimulation and attractive for adolescent, to overcome difficulties they experience, to reduce fatigue and unhappiness, and as a model according to respective sex.

Results of Griffiths, MD., Davies, MNO., & Chappell, D.'s research (2004), a leveling-up factor (the increased level), making a gamer to be more and more curious about the game at the next level and what difficulty level will be encountered next. In the process of identity searching, adolescents are increasingly challenged by subsequent difficulty levels and other kinds of game. Further, a *prestige* factor (appreciation) from other gamers when he/she is able to resolve a game level that has never been solved before. In addition, *reward* (prize) factor won in an online gaming can be transferred or sold for money with other gamers. If adolescents already have what is called emotional intelligence, they will be able to control their emotion and desire to play online game. Based on the existing theory, then hypothesis of the

research can be concluded, namely there is a negative correlation between intensity of playing games online and emotional intelligence of adolescent.

## METHOD OF THE RESEARCH

Independent variable of the research is intensity of playing online games and dependent variables is emotional intelligence.

The subject is 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup> grades students of SMP A and SMP B Kartasura. Method used to collect data of the research is a questionnaire using Likert-type scale and a scale of Rating Scale model. Two questionnaires are used to collect data about online gaming, namely scale of the intensity of playing online game and the scale of emotional intelligence.

The research uses analysis of Pearson's Product Moment. The calculation is assisted by SPSS software program and conducted by Data Processing Division of Psychology Faculty of Muhammadiyah University of Surakarta.

## RESULTS AND DISCUSSION

Calculation of the research's hypothesis testing used correlation analysis of product moment and obtained  $r_{xy} = -0.190$ , with significance ( $p$ ) = 0.024, ( $p$ )  $\leq$  0.05. Thus, there is a significant, negative correlation between the intensity of playing games online and emotional intelligence.

Result of the analysis showed a significant and negative correlation between the intensity of playing online games and emotional intelligence. It means that the higher intensity of playing online games, the lower emotional intelligence, and on the contrary. The lower intensity of playing online games, the higher emotional intelligence

In accordance with Steinkuehler's research (Journal of Computer-Mediated Communication, 2006), the use of game media had led to decreased civic and social involvement, because the game media is a substitute for direct involvement in contemporary social world. Online games help online interaction, and help in equipping and providing a new world and ideas. However, the social benefits acquired is lasting in short term only, since online gaming is typical more for people who are shy, fanatic, always want to be stand out and get attention who chose to isolate themselves from others.

Results of the research are also in line with research of Pratiwi, et al (2012) on 76 adolescents with age ranged from 13 to 18 years old (junior high school to high school) and experienced an online gaming addiction. Results of the study indicated a negative correlation between academic

self-efficacy and social skills and online gaming addiction behavior.

Reinforced by Xu's study (European Journal of Information Systems, 2012), it is known that an individual is playing online games as a desire to be part of the game and serving his/her social needs that are not acquired in real life, so he/she will be deeply involved in the online gaming world that unconsciously develop a sense of shame, dependency, depression, aggression, low self-esteem, low self-control, and narcissism further.

Effective contribution (SE) of 3.6% showed that many other factors (96.4%) affect emotional intelligence. Another factor affecting the emotional intelligence was revealed by Goleman (2001), namely, experience, age, gender, and occupation factors. Shapiro (2001) also argued that emotional intelligence is influenced by age and emotional education that had been received by an individual.

The intensity of playing online games is categorized as moderate, while emotional intelligence is categorized as high although there were 26.85% of the subjects belonged to moderate category. This suggests the need for improved and equitable distributed emotional intelligence. Improved emotional intelligence can be achieved by enhancing self-confidence, seriousness in establishing communication, developing interest, and growing physical and psychological assets. The better emotional education the youth received, the better emotional intelligence (Shapiro, 2001).

In order to create a good emotional intelligence, it is important to give a correct understanding of the use of technology, especially online games as a means of entertainment. The increased and prevalent emotional intelligence will allow the subject to recognize and understand themselves and others, to motivate himself/herself and others, more empathetic and clever in developing a relationship with others.

## CONCLUSION AND SUGGESTION

There is a significant and negative correlation between intensity of playing online games and emotional intelligence. Effective contribution of the variable of online gaming intensity to emotional intelligence is 3.6%. Subjects' level of emotional intelligence is categorized as very high. Intensity of playing online games of the subjects is categorized as moderate.

For the subject, information of the study can make them to be more careful and wiser in socialization and in playing online games, because it can provide both good and bad effects, other factors such as age and experience should be paid attention in order to improve emotional intelligence.

For parents who have adolescent aged children should be more cautious and more careful in supervising and educating children in order to prevent their children to get caught up in social life and technological advances that may have negative effects and harmful for them.

For schools, results of the research can provide an idea in providing the right knowledge and understanding in terms of appropriate use of technology and to be more careful in watching their students in order to prevent them to be affected easily by negative things that may have bad impact for students.

For society, results of the study can provide a picture for public so that they will use technology appropriately and supervise development of adolescent around them.

Referring to the effective contribution of the intensity of playing online games of 3.6%, next research is suggested to examine other factors that may affect emotional intelligence such as experience, age, gender, occupation, emotional education, and so forth to develop and improve emotional intelligence further.

## REFERENCES

- Adams, E & Rollings, A. 2007. *Game Design and Development*. USA: New Reader Publishing
- Azwar, 2010. *Metode Penelitian*. Yogyakarta : Pustaka Pelajar.
- Bintarti, 1997. *Artikel "Kembangkan Daya Pikir Anak Dengan Dongeng Menarik"*. Jakarta: Kompas
- Chaplin, J.P. 1999. *Kamus Lengkap Psikologi*. Jakarta: Raja Grafindo Persada
- Fatimah, E. 2006. *Psikologi Perkembangan (Perkembangan Peserta Didik)*. Cetakan Pertama. Bandung: Pustaka Setia
- Goleman, D. 2000. *Kecerdasan Emosi untuk Mencapai Puncak Prestasi*. Cetakan Keempat. Jakarta: Gramedia
- \_\_\_\_\_, 2001. *Kecerdasan Emosi untuk Mencapai Puncak Prestasi*. Cetakan Keempat. Jakarta: Gramedia
- \_\_\_\_\_, 2007. *Kecerdasan Emosional*. Cetakan Ketujuh Belas. Jakarta: Gramedia
- Griffiths, M.D, Davies, M.N.O, & Chappell, D. 2004. Demographic factors and playing variables in online computer gaming. *Journal of Cyber Psychology & Behavior*, 7, 479-487
- Hasman. 2009. *Kecerdasan Emosional*. hasmansulawesi01.blogspot.com/2009/02/hubungan-kecerdasan-emosional-dengan.html (diakses pada tanggal 2 Desember 2012)

- Horrigan, J.B. 2002. New Internet Users: What They Do Online, What They Don't, and Implications for the „Net's Future. *Pew Internet and American Life Project* pg. 1-27
- Monks, F.J & Knoers, A.M.P. 1999. *Psikologi Perkembangan*. Yogyakarta: Universitas Gajah Mada
- Nissa. 2003. *Cerita gaya hidup remaja*. <http://www.ceritamu.com/cerita-gaya-hidup/Remaja/Artikel/Trend-Remaja-Kita> (diakses pada tanggal 10 November 2012)
- Pratiwi, P.C., Andayani, T.R., & Karyanta, N.A. 2012. Perilaku Adiksi *Game-online* Ditinjau dari Efikasi Diri Akademik dan Keterampilan Sosial pada Remaja di Surakarta. Surakarta: Universitas Sebelas Maret Surakarta
- Shapiro, E.L. 2001. *Kecerdasan Emosional* (terjemahan Alex Tri Kantjono). Jakarta : Gramedia
- Sitorus, E.D. 2003. *The Art of Acting*. Cetakan Kedua. Jakarta: Gramedia Pustaka Utama
- Stein, S.J. & Book, H.E. 2002. *Ledakan EQ* (penerjemah Trinanda Rainy Januarsari). Bandung: Kaifa
- Steiner. 1997. *Kecerdasan emosional* <http://alytpuspitasari.wordpress.com/2010/06/07/kecerdasan-emosional/> (diakses pada tanggal 7 November 2012)
- Steinkuehler, C., & Williams, D. 2006. Where everybody knows your (screen) name: Online games as "third places." *Journal of Computer-Mediated Communications*, 11(4)
- Sternberg, R.J. 2008. *Psikologi Kognitif*. Yogyakarta: Pustaka Pelajar
- Suharsono. 2003. *Mencerdaskan Anak*. Jakarta: Inisiasi Press
- Xu, Z., Turel, O., & Yuan, Y. 2012. Online game addiction among adolescents: motivation and prevention factors. *European Journal of Information System*, 21, 321-340
- Yee, N. 2002. Understanding MMORPG Addiction. *Ariadne*, pg. 1-16

## GAIN AND LOSS OF COMPARATIVE ADVANTAGE AMONG ASEAN-6

**Yuli Utami**

Lecturer in International Program for Islamic Economics and Finance,  
Department of Economics - University Muhammadiyah Yogyakarta  
yulut321@yahoo.com/yuliutami@umy.ac.id  
(62-85729989054)

### ABSTRACT

*The aim of ASEAN trade is to reduce tariff and nontariff barriers to goods produced in member countries. Therefore, it is significant to determine whether Asean members gain or loss from their trade. This paper examines the gain and loss of comparative advantage among Asean-6. We employ secondary data of revealed comparative advantage (RCA) for Asean-6. The results obviously indicate that all Asean-6 countries gain from their trade.*

**Keywords:** *Comparative Advantage, Revealed Comparative Advantage (RCA), ASEAN-6, OLS, Augmented Dickey Fuller test (ADF).*

### 1. INTRODUCTION

The ASEAN preferential trading arrangements, established in 1977, sought to expand intra-ASEAN trade by reducing tariff and nontariff barriers to goods produced in member countries. Only negligible increases in trade within the region were achieved, however, because of persistent, though generally declining, reliance on nontariff barriers in many ASEAN countries and, more fundamentally, because of the opposition of many of the same vested interests that have prevented the success of the coordinated ASEAN investment programs. In January 1992, the ASEAN heads of state, concerned about the increasing bilateralism of the major industrial countries, agreed to establish the ASEAN Free Trade Area. Beginning in 1995, each ASEAN country will reduce the level of its tariffs on imports of manufactures and highly protected categories of agricultural and other natural resource-based commodities from within the region to a range of 0 to 5 percent by year 2003. The AFTA agreement also calls for simultaneous elimination of nontariff barriers to trade within ASEAN.

Steven (1997-2003) mentions that the theory of comparative advantage is perhaps the most important concept in international trade theory. Supported by Li (2002), the theory of comparative advantage predicts that trade specialization could maximize welfare and prosperity.

To determine whether the ASEAN-6, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam are at a comparative advantage, we use traditional revealed comparative advantage (RCA) to make a comparison among the Asian countries (Balassa, 1965, 1977, 1979 and 1986). This study will try to give a clearer picture on their gain and loss from trade. We will employ the concept of substitution and complementary as applied in explicative model (Li, 2002).

### 2. STATEMENT OF THE PROBLEM

The comparative advantage is important when there is trade between or among the countries. However, it is not obvious enough to point out whether a country gains or losses from trade. This study will try to highlight and elucidate any ambiguities in relation to the comparative advantage theory.

### 3. OBJECTIVE

- 3.1. To have better understanding about the concept of revealed comparative advantage (RCA).
- 3.2. To determine gain and loss based on the comparative advantage concept among Asian countries.

### 4. ORGANIZATION OF THE STUDY

In the next section, firstly, we shall discuss the theoretical framework of comparative advantage. Secondly, we will review the literature on comparative advantage focusing on revealed comparative advantage (RCA). Thirdly, we shall discuss the data and methodology to be used in this study. This section begins with introduction of data followed by the methodology which can be divided into four main parts. First, we will test the stochastic properties of the series by using the unit root tests. Second, we will investigate cointegration relation among the variables. Third, we will investigate Granger causality by using Johansen's full information maximum likelihood procedure. Forth, we will use OLS (Ordinary Least Squares) to estimate gain and loss from trade. The final section will summarize and conclude the whole study.

## 5. THEORETICAL FRAMEWORK

In economics, the theory of comparative advantage explains why it can be beneficial for two countries to trade even though one of them may be able to produce every kind of item more cheaply than the other. What matters is not the absolute cost of production, but rather the ratio how easily the two countries can produce different kind of things.

There are many articles that cover the comparative advantage theory. This theory can be viewed from various aspects. First, the theory is described by Robert Torrens in a 1815 essay on corn trade. He concludes that it is England's advantage to trade various goods with Poland in return for corn, even though it might be possible to produce that corn more cheaply in England than Poland. However, a clearer explanation usually attributed to David Ricardo 1817 book, *The Principles of Political Economy and Taxation* which uses England and Portugal as a case study. In Portugal it is possible to produce both wine and cloth with less work than it takes in England. However, the relative costs of producing those two goods are different in the two countries. In England it is very hard to produce wine, and only moderately difficult to produce cloth. In Portugal both are easy to produce. Therefore, while it is cheaper to produce cloth in Portugal than England, it is cheaper still for Portugal to produce excess wine, and trade that for England cloth. And conversely England benefits from this trade because its cost for producing cloth has not change but it can now get wine at closer to the cost of cloth (Wikipedia, 2004).

Markusen, et.al (1995) give the definition of comparative advantage i.e. a country has a comparative advantage in X if its opportunity cost of X in terms of Y is less than in other country<sup>1</sup>, where X and Y referred to goods. Furthermore, they cited Ricardo (1817) which notes that as long as some pattern of comparative advantage exists, there will be gain from trade, regardless of whether one country has an absolute advantage in all goods. The absolute advantage in this sense refers to a country which produces goods X more than other country by using one unit of labor.

Daniel (2004) mentions that comparative advantage is defined in terms of relative autarky prices, which are generally not observable; the empirical comparative advantage literature has had to take the intermediate step of relating autarky prices to observable features such as factor supplies and measure of technological differences.

<sup>1</sup> Markusen, J.R., Melvin, J.R., Kaempfer, W.H., Maskus, K.E., "International Trade Theory and Evidence" Chapter 5. McGraw-Hill, Inc. 1995.

Alan (1998) explains the comparative advantage as low relative cost of a good compared to other countries. He further clarifies the concept of the positive law of comparative advantage which is if there is permission to trade; a country will export goods in which it has a comparative advantage. On the other hand, the normative law of comparative advantage means that, if permitted to trade, a country will gain or has benefits of trade which exceed costs.

Both of laws are illustrated using a numerical such as David Ricardo to explain comparative advantage. It has two countries and two goods, both of which are used only for consumption, only one factor of production (homogeneous labor), perfect competition, and perfectly free trade without even transport cost<sup>2</sup>.

## 6. REVIEW OF LITERATURE

This section reviews the existing literature on three main points which are trade among Asean-6, comparative advantage, and RCA, in order to have a better understanding of gain and loss of comparative advantage among Asean-6.

Xiaming (2000) examines the change in China's comparative advantage in manufacturing from 1987 to 1995, in favor of high-tech industries. His study considers 28 major product groupings at three-digit industries classification level employing two measurements, namely revealed comparative advantage (RCA) and the net trade ratio (NTR). The results indicate that while China still maintain its comparative advantage in low-tech and labor-intensive products, the country has been developing in comparative advantage in the range of medium-tech and more capital goods. At the same time, it has also gained or is in the process of gaining a revealed comparative advantage in the high-tech product grouping of communications equipment and automatic data processing equipment. However, from his finding there is a failure of yet to achieve any comparative advantage in a number of other high-tech sectors. He further explains the test from RCA and NTR to affirm that the change in China's comparative advantage is not driven simply by shift in basic factor endowment.

Li (2002) studies the gain and loss in export advantage among world regions by using the UNIDO 1999 database. The objective of this study is to find out the revealed comparative advantage of

<sup>2</sup> Alan, V.D, 1998. "Benefits and Costs of Flowing Comparative Advantage". The Sweetland Lnaugural Lecture, Presented at the 45<sup>th</sup> Annual Conference on the Economics Outlook, Ann Arbor, Michigan.

manufacture export among seven world regions. Those are European Union (EU), North America (NA), Latin America (LA), South Asia (SA), Oceania (OC), East Asia (EA), and association of Southeast Asian Nations, consist of Indonesia, Malaysia, Philippines and Thailand. The result indicates that European and East Asian economics lose in export advantage, while the Southeast Asian and Latin America economics have gained. He further explains by using an explicative model<sup>3</sup> to identify the gainers and losers across the region. The result shows that the gain in the comparative advantage in one region is matched with the loss in the comparative advantage of the same sector in another region.

Nguyen (2002) stresses on the issues of comparative advantage and international trade regime of Vietnam. This study tries to examine whether Vietnamese firms are able to take an advantage of markets when the economy is completely open to the world. A part of this study use the revealed comparative advantage (RCA) to measure and reflect the underlying comparative advantage of Vietnam in particular commodities compared to 6 Asian countries, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. The results show that in 1995-1998, Vietnam's comparative advantage mostly lies in primary commodities in stance a cereals, coffee, hides, oil seed, rubber, fish, coal, wood, and crude oil. Moreover, Vietnam is strong in some labor intensive manufactured goods including travel goods, textiles, clothing and furniture.

Daniel (2004) provides an empirical assessment of the comparative advantage gain from trade by using evidence from Japan's 19<sup>th</sup> century. He explains that although comparing an economy in a state of autarky relative to a state of free international trade would affect the wealth nation, however where market economy engages in foreign trade, the empirical trade literature has not been

able to generate estimates of the gains from trade based on the autarky-free paradigm of the theoretical trade.

## **7. METHODOLOGY AND SOURCE OF DATA**

### **7.1. Data and Variables**

In this study, we attempt to evaluate gain and loss of comparative advantage among Asean-6, namely Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam.

We use annual secondary data from the study that has been done by Nguyen (2002). The data provided in table 1 represents the revealed comparative advantages (RCAs) for 6 ASEAN countries during 1995-1998. This study will further employ explicative model in order to determine whether those countries gain or loss from trade, elaborated by using concepts of substitution and complementary which indicate the relationship that exists between the different countries.

Any number in excess of one may be taken as an indicator of the existence of a comparative advantage in that product. The index allows clearer comparisons between countries at any time, and allows changes in comparative advantage to be tracked over time. The measure reflects the underlying comparative advantage of the country in particular commodities as determined by technology and factor endowments, modified by government policies designed to draw resources into favored sectors.

---

<sup>3</sup> However, since the gains and losses of revealed comparative advantage among the regions are related one to each other, we note that the "explicative" variables in each equation (and for each sector) are not truly independent from the "dependent" variable. Therefore, the estimated coefficients should be interpreted appropriately as partial correlations estimates among those variables. We consider those partial correlations estimates as special in the sense that they were obtained by the simultaneous equation procedure for precluding inconsistencies in the "complementary" or "substitution" relationship estimates between country groups.

Table 1. Revealed Comparative Advantage for ASEAN-6\* (1995-1998 Average)

SITC	Description	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
00	Live Animals except Fish	0.2620	1.616	0.053	0.0423	0.166	0.003
01	Meat and Preparations	0.0600	0.043	0.003	0.025	1.237	0.236
02	Dairy Products and Eggs	0.0290	0.249	0.014	0.153	0.162	0.104
03	Fish and Preparations	3.8180	0.483	2.249	0.121	9.092	10.55
04	Cereals and Preparations	0.1500	0.264	0.163	0.154	6.24	5.89
05	Fruit and Vegetables	0.0426	0.187	1.932	0.212	1.97	0.642
06	Sugar and Pres Honey	0.3250	0.289	1.452	0.119	6.167	0.764
07	Coffee Tea Cocoa Spices	4.1590	0.663	0.192	0.859	0.423	10.27
08	Animal Feeding Stuff	0.7210	0.394	0.667	0.12	1.125	0.092
11	Beverages	0.0230	0.185	0.091	0.687	0.295	0.121
12	Tobacco and MFRS	0.9660	0.374	0.348	2.139	0.322	0.936
21	Hides, Skins, Furs Undrstd	0.0210	0.041	0.018	0.122	0.029	1.95
22	Oil seeds, Nuts, Kernels	0.0830	0.56	0.077	0.097	0.049	9.06
23	Rubber Crude, Synthetic	14.2800	6.885	0.472	1.717	16.64	9.217
24	Wood Lumber and Cork	0.8550	4.187	0.193	0.191	0.268	2.728
25	Pulp and Waste Paper	2.8740	0.017	0.424	0.168	0.31	0.004
26	Textile Fibres	0.5460	0.364	0.249	0.144	0.842	0.815
27	Crude Fertilizer, Minris Nes	0.8100	0.244	0.329	0.195	1.468	0.237
28	Metalliferous Ores, Scrap	4.1890	0.186	1.315	0.257	0.223	1.459
29	Crude Animal, Veg Mat Nes	0.5960	0.225	1.909	0.686	1.011	2.611
33	Petroleum and Products	2.0560	0.777	0.144	1.2	0.216	2.636
41	Animal Oils and Fats	0.1110	0.085	0.006	0.006	0.061	0.004
42	Fixed Vegetables Oil, Fat	7.6520	13.86	7.898	7.898	0.149	0.786
43	Processed Anml Veg Oil, etc	7.1740	17.63	1.076	1.76	0.289	0.009
51	Chem Elements, Comounds	0.5860	0.379	0.098	0.098	0.314	0
52	Coal, Petroleum etc Chems	0.3310	0.134	0.158	0.158	0.276	0
53	Dyes, Tanning, Color Prod	0.2390	0.34	0.071	0.071	0.608	0
54	Medicinal etc Products	0.0610	0.065	0.079	0.079	0.132	0.004
55	Perfume, Cleaning etc Prod	0.5540	0.378	0.242	0.242	0.425	0.297
56	Fertilisers Manufactured	1.6560	0.403	1.43	1.43	0.82	0.233
58	Plastic Materials etc	0.0860	0.119	0.078	0.078	0.346	0.117
59	Explosive, misc chemical etc	0.2060	0.795	0.213	0.213	0.693	0
61	Leather, Dressed Fur, etc	0.2360	0.207	0.082	0.082	1.834	0.377
62	Rubber Manufactures Nes	0.7060	0.703	0.184	0.184	1.23	1.431
63	Wood, Cork Manufacts	14.8070	4.72	1.152	1.152	1.009	1.201
64	Paper, Paperboard and Mfr	1.1940	0.195	0.145	0.145	0.36	0.089
65	Textile Yarn, Fabric etc	1.7760	0.546	0.425	0.425	1.228	5.23
66	Nonmetal Mineral Mfs Nes	0.3490	0.403	0.266	0.266	1.514	0.511
67	Iron and Steel	0.3010	0.278	0.085	0.085	0.338	0.194
68	Non-ferrous Metals	0.7190	0.544	0.811	0.511	0.193	0.527
69	Metal Manufactures Nes	0.4330	0.516	0.273	0.273	0.745	0.1
71	Machinery, Non-Electric	0.1540	0.37	0.071	0.071	0.563	0.008
72	Electrical Machinery	0.0940	0.232	0.101	0.101	0.152	0.097
73	Transport Equipment	0.0200	0.192	0.249	0.249	0.284	0.103
75	Office Machines	0.3120	2.632	2.625	2.625	2.604	0.008
81	Plumbg, Heating, Lghtng Equ	0.2760	0.302	0.338	0.338	0.809	0.156
82	Furniture	1.5900	1.534	1.408	1.408	1.426	1.103
83	Travel Goods, Handbags	0.6560	0.177	2.89	2.89	2.815	3.781
84	Clothing	1.9390	0.935	2.675	2.675	2.288	2.965
85	Footware	4.4840	0.161	0.915	0.915	3.293	11.35
87	Medical Instruments Nes	0.0360	0.377	0.156	0.156	0.313	0.083
89	Misc Manufactrd Good Nes	0.8000	0.619	0.643	0.643	1.402	0.327

## 7.2. Empirical Framework

This study is concerned with identifying comparative advantage. Several measures of comparative advantage have been adopted in the literature. One is the “revealed comparative advantage (RCA) index developed by Balassa (1965). This index is calculated by dividing a country’s share in the exports of a given commodity category by the share in the world exports of manufactured goods and is used to identify those products in which a country does or does not have a comparative advantage. If  $x_{ij}$  is the value of country  $i$ ’s exports of product  $j$  and  $X_{it}$  is the country  $i$ ’s total exports, its revealed comparative advantage index is:

$$RCA_{ij} = (x_{ij} / X_{it}) / (X_{wj} / X_{wt}) \quad (1)$$

where the  $w$  subscript denotes world total. If the index takes a value greater than unity then the share of product  $j$  in country  $i$ ’s exports is larger than the corresponding world share. This means that country  $i$  has a revealed comparative advantage in product  $j$ . If the value is less than unity then the country has a revealed comparative disadvantage. This index has been widely used in identifying comparative advantage for a country or region. Examples include Petri (1988), Yeats (1989, 1992a, 1992b, 1998), World Bank (1994), Lee (1995), Hoekman and Djankov (1997) and Rodas-Martini (1998). The method is sometimes criticised, however, for neglecting the import side of trade (Lundberg, 1988).

In order to avoid spurious regression, we need to detect the stationary of the series by using unit root test. We use Augmented Dickey Fuller test (ADF) and Phillips-Perron unit root tests (PP) to ensure the stationary of the variables. The ADF test consists of estimating the following regression.

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha_i \sum_{i=1}^m \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

Where  $Y_t$  is our variable of interest (Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam),  $\Delta$  is differencing operator,  $\{\beta_1, \beta_2, \delta, \alpha_1, \dots, \alpha_m\}$  is the set of parameter to be estimated,  $\Delta Y_{t-1} = (\Delta Y_{t-1} - \Delta Y_{t-2})$ ,  $\Delta Y_{t-2} = (\Delta Y_{t-2} - \Delta Y_{t-3})$ , etc.  $\varepsilon_t$  is a pure white noise error term. The number of lagged difference terms to include is often determined empirically, the idea being to include enough terms so that the error term in (1) is serially uncorrelated. In ADF, we test whether  $\delta = 0$ , therefore the null and alternative hypothesis in unit root tests can be written as following:

$H_0: \delta = 0$  ( $Y_t$  is nonstationary or there is unit root)

$H_1: \delta < 0$  ( $Y_t$  is stationary or non unit root)

The unit root hypothesis of the Augmented Dickey Fuller test (ADF) can be rejected if the  $t$ -test statistic is less than (lies to the left of) the

critical value, meaning that the variable which to be estimated is stationary. If we cannot reject the null hypothesis as underlying premise is that time series have unit root or nonstationary in the levels, however it might be stationary in the first differences.

The Phillips-Peron (PP) unit root tests, on the other hand uses nonparametric statistic method to take care of the serial correlation in the error terms without adding lagged different terms. The asymptotic distribution of the PP test is the same as the ADF test statistic. To guarantee that the variables are stationary, we employ both Augmented Dickey Fuller test (ADF) and Phillips-Perron unit root tests (PP) in our study.

If the data is not stationary at the level, we have to employ the concept of cointegration as it provides a formal framework for testing and estimating long-run (equilibrium) relationship among economics variables.

To perform cointegration test, we construct null hypothesis as there is non cointegration among variables. If Trace statistic exceeds the critical value then we will reject null hypothesis meaning that there is cointegration among the variables. Since the results from the cointegration tests may be sensitive to the lag structure chosen, then we determine the proper lag profile on the basis of the Akaike Information Criteria (AIC) procedure.

We employ Granger causality test to determine the direction of influence between variables. In other words, this test is to analyze which variable precedes or leads the other. The null hypothesis is that there is causality between the variables.

We utilize OLS (Ordinary Least Squares) to estimate gain and loss from trade. Based on the homogeneity of RCA suggests that a gain or loss of RCA in a given sector for a country or region must have occurred at the expenses of another country or region. The sectors’ “substitution” or “complementary” relationships that existed between the different country groups can help to identify where in a particular country group and sector the gain of RCA has come from, or where the loss has gone to. This is done by employing, for each sector, the following “explicative” model as follows

$$R_{n,t}^i = \alpha_{i0} + \sum_{j=1}^6 \alpha_{ij} R_{n,t}^j + \beta_{ii} R_{n,t-1}^i + \varepsilon_i \quad (3)$$

$R$  stands for RCA,  $i$  and  $j$  ranges from 1 to 6, with 1 = Indonesia, 2 = Malaysia, 3 = Philippines, 4 = Singapore, 5 = Thailand, and 6 = Vietnam,  $t$  is time and  $n = 1, 2, 3, \dots, 52$  sectors. We set coefficient  $\alpha_{ij} = 0$ , when  $i = j$ . When  $i \neq j$ , a positive value of  $\alpha_{ij}$  would mean a “complementary” relationship



between the two regions, while a negative value suggests a “substitution” relationship (Li, 2002).

The gain and loss of respective RCA can be captured by the various “explicative” variables ( $R_{n,t}^j$ ) in Equation (1). The inclusion of the lagged dependent variable ( $R_{n,t-1}^i$ ) can capture a situation where for a given sector the region under consideration has experienced a tendency of gain (or loss) in RCA over time.

## 8. DATA ANALYSIS AND DISCUSSION THE RESULTS

### 8.1. Unit Root Test

The unit root test is the methodology of econometrics to test data whether the variables are stationary or not. This study involves the observation of stationary properties of the time series under consideration of Augmented Dickey Fuller (ADF), and supported by Phillips- Perrons (PP) test.

The null hypothesis of unit root test is that the series are non-stationary. If the absolute value of ADF excess t-statistic and probability (p-value) is less than the level of significance, we can reject the null hypothesis, otherwise not. The determination of the individual lag of the variable is based on the minimum of Akaike Information Criteria (AIC).

Table 1 shows the summarized results of unit root tests. We estimate both test with and without time trend. The results indicate that for ADF and PP test at the level can reject the null hypothesis at 1% level of significance. Therefore, from results of our study we can conclude that all the variables stationary at the level.

As mentioned before that if the data is not stationary at the level, we have to employ the concept of cointegration as it provides a formal framework for testing and estimating long-run (equilibrium) relationship among economics variables. Since the data of our study is stationary at the level then we can move on to next step which is Granger causality.

Table 1. Unit root tests Summary Statistics

Variables	Lag length (SC)	ADF-t statistics (Level)		PP-t statistics (Level)	
		With time trend	Without time trend	With time trend	Without time trend
Indonesia	0	-7.095229***	-5.694272***	-7.172556***	-5.779499***
Malaysia	1	-5.119375***	-4.419651***	-4.294822***	-4.109876***
Philippines	0	-6.579460***	-5.129839***	-6.579527***	-5.333714***
Singapore	0	-6.224824***	-4.967975***	-6.224824***	-5.142541***
Thailand	0	-6.974840***	-5.416626***	-6.974840***	-5.615306***
Vietnam	0	-5.682521***	-4.469530***	-5.601654***	-4.448022***

Note: \*, \*\*, \*\*\*denote significance at 10%, 5%, and 1% respectively.

### 8.2. Granger Causality

We employ Granger causality test to determine the direction of influence between variables. In other words, this test is to analyze which variable precedes or leads the other.

We estimate the results by comparing p-value with level of significance. If p-value is less than level of significance it means that there is causation from one variable to another, otherwise not.

Table 2 presents the Granger Causality tests for Indonesia, Malaysia, Philippines, Singapore, Thailand, and Vietnam. The results indicate that first; the revealed comparative advantage (RCA) index in Indonesia causes RCA in Malaysia and Thailand. Second, Malaysia RCAcauses RCA in Indonesia and Singapore. Third, Philippines RCA causes RCA in Singapore. Forth, Singapore RCA

causes RCA in Malaysia and Philippines. Fifth, Thailand RCA causes RCA in Indonesia and Vietnam. Sixth, Vietnam RCA causes RCA in Thailand.

The results somewhat interestingly show that the causalities for all the countries have two directions in the senses that the countries will cause each other. For example, Vietnam RCA causes RCA in Thailand, the result obviously indicate that Thailand RCA also cause RCA in Vietnam.

As mentioned, revealed comparative advantage (RCA) index developed by Balassa (1965) is calculated by dividing a country’s share in the exports of a given commodity category by the share in the world exports of manufactured goods and is used to identify those products in which a

country does or does not have a comparative advantage.

The Granger causality test only examines the causation from one variable to another. In order to

have clearly picture of comparative advantage we employ the concept of explicative model (Li, 2002) by using OLS (Ordinary Least Squares) to estimate gain and loss from trade.

Table 2. Granger Causality Test

Dep. var	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
<b>Wald Statistics</b>						
<b>Indonesia</b>	-	18.01305 (0.0001)	0.705518 (0.4055)	0.438108 (0.5115)	5.564498 (0.0228)	2.767145 (0.1033)
<b>Malaysia</b>	15.37607 (0.0003)	-	0.000462 (0.9830)	6.306866 (0.0158)	0.000404 (0.9841)	1.598326 (0.2128)
<b>Philippines</b>	0.978419 (0.3280)	0.020621 (0.8865)	-	92.97829 (0.0000)	1.085044 (0.3033)	0.008748 (0.9259)
<b>Singapore</b>	0.444554 (0.5084)	4.302705 (0.0439)	87.61385 (0.0000)	-	1.513942 (0.2251)	0.230193 (0.6338)
<b>Thailand</b>	5.820883 (0.0201)	0.123685 (0.7268)	1.194202 (0.2804)	1.381152 (0.2462)	-	9.378856 (0.0037)
<b>Vietnam</b>	2.623714 (0.1124)	2.333305 (0.1338)	0.002212 (0.9627)	0.129878 (0.7203)	7.654568 (0.0082)	-

Note: The values in parentheses are the probabilities.

### 8.3. OLS (Ordinary Least Squares)

We employ six variables; we have only 8 degree of freedom. The critical value for rejection of null hypothesis equals to 2.306 at 5% significant level. This value is quite high and we predict that for some sectors only few coefficient estimates could statistically be significant from zero.

First, we predict the estimate for the coefficients  $\beta_{ii}$  is positive, but a negative suggests a declining tendency in the sector's RCA. Secondly, we assume there is no inconsistency in the "complementary" and "substitute" relationships between the country groups. Namely, a gainer country group cannot be a loser at the same time. Thirdly, the gain in RCA can be due to endogenous improvement in that particularly sector, resulting in a situation in which there is no corresponding loss of RCA in other region.

Table 3 represents the regression estimates for Asean-6. The columns represent the "explicative" variables. The estimate of the lagged variable,  $\beta_{it}$ , is shown in the diagonal entries. For example, in the Malaysia-by-Malaysia cell, the lagged estimate is 0.443.

We only report the results which are significant. Table 3 indicates that all Asean-6 have complementary relationships, there is no existence of substitution relationship. Instance in the first row

of Table 3 tells us that the Indonesia has a "complementary" relationship with Malaysia and Thailand. We can summarize the "complementary" relationship in Table 3 for Asean-6 as follows:

Indonesia : Malaysia, Thailand  
Malaysia : Indonesia  
Philippines : Singapore  
Singapore : Malaysia, Philippines  
Thailand : Vietnam  
Vietnam : Thailand

Li (2002) examines the gain and loss in export advantage among world regions by using the UNIDO 1999 database. He finds that the gain in the comparative advantage in one region is matched with the loss in the comparative advantage of the same sector in another region.

If we compare our results to the study of Li (2002), we can obviously detect that both studies show the gain from trade. This can be detected from the complementary relationship between two countries or regions. However, substitution relationship only appears in the study of Li, but not in our study. The reasons that make the results different is that first, according to Li (2002) explains that gain in RCA was due to its own endogenous factors, such as productivity; therefore the difference of the results in both studies might be caused by the difference in productivity. Second,

due to intra-ASEAN trade effort to reduce tariff and nontariff barriers to goods produced in member countries. This would be beneficial for the Asean members in the sense that they can gain from trade and improve their welfare. This reason might have

made our results different from the study of Li because his study attempts to compare the gain and loss from trade among world region, not only in the certain group of trade i.e. ASEAN.

Table 3. Regression Results for Asean-6

Dep. var	Indonesia	Malaysia	Philippines	Singapore	Thailand	Vietnam
<b>Indonesia</b>	-0.100 (-0.942)	0.572* (4.244)	-0.430 (-0.839)	0.386 (0.662)	0.324* (2.358)	0.200 (1.663)
<b>Malaysia</b>	0.443* (3.921)	0.350* (4.072)	-0.009 (-0.021)	1.201* (2.511)	-0.002 (-0.020)	-0.134 (-1.264)
<b>Philippines</b>	-0.044 (-0.989)	0.007 (0.143)	-0.054 (-0.615)	0.920* (9.643)	0.043 (1.041)	0.003 (0.093)
<b>Singapore</b>	0.026 (0.667)	0.099* (2.074)	0.734* (9.360)	-0.054 (-0.636)	-0.046 (-1.230)	0.016 (0.480)
<b>Thailand</b>	0.357 (2.412)	-0.055* (-0.352)	0.578 (1.093)	-0.697 (-1.175)	-0.038 (-0.314)	0.374* (3.062)
<b>Vietnam</b>	0.286 (1.620)	-0.268 (-1.528)	-0.029 (-0.047)	0.252 (0.360)	0.470* (2.767)	0.061 (0.464)

Note: Figure in parentheses are t-statistics.  
\* significant at 5%

## 9. POLICY IMPLICATION

According to Ricardo (1817) affirms that as long as some pattern of comparative advantage exists, there will be gain from trade. This is supported by Markusen (1995) who stress that gain from specialization will always exists if the countries have different opportunity cost i.e. if there exists some pattern of comparative advantage.

In order to impose the policy, the government should support by giving the subsidies to the products which have comparative advantage because that will boost gain from trade.

Considering the revealed comparative advantage for ASEAN-6 from 1995-1998, we divide data into two sectors which are Agricultural and Industrial. The products in Agriculture sector such as Fruit and Vegetables, Meat and Preparations, and Dairy Products and Eggs, etc. The products in Industrial sector such as Animal Feeding Stuff, Fertilisers Manufactured, and Plastic Materials, etc.

We compare the revealed comparative advantage between Agricultural sector and Industrial sector. The result shown in figure1 indicates that all the ASEAN-6 countries dominate in Industrial sector.

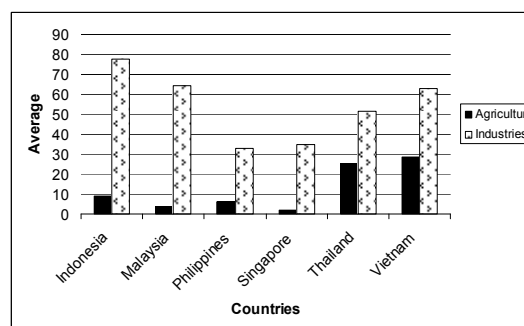


Figure 1. Revealed Comparative Advantage for ASEAN-6\* (1995-1998 Average)

Considering the revealed comparative advantage (RCA) index developed by Balassa (1965), this index is calculated by dividing a country's share in the exports of a given commodity category by the share in the world exports of manufactured goods and is used to identify those products in which a country does or does not have a comparative advantage. This implies that RCA indicate the export of commodity, i.e. higher RCA of goods X, higher export of goods X.

The results from our study show high RCA in Industrial sector, which implies that ASEAN-6 countries export more in Industrial commodity rather than Agricultural commodity. We summaries the higher RCA of commodity of each country that can be elaborated as:

Table 4. RCA of commodity of each country

Countries	SITC	Commodities	RCA	Percentage of RCA in own country
Indonesia	63	Wood, Cork Manufacture	14.807	19%
Malaysia	43	Processed Anml Veg Oil	17.63	27%
Philippines	42	Fixed Vegetables Oil, Fat	7.898	24%
Singapore	42	Fixed Vegetables Oil, Fat	7.898	23%
Thailand	23	Rubber Crude, Synthetic	16.64	32%
Vietnam	85	Footware	11.35	18%

Therefore, the government of each country should support the producers who produce the commodities that give high RCA by giving the subsidies, reduce the tax, etc. Such as in Indonesia, the government should support the producers who produce Wood, Cork Manufacture, Indonesia would gain a large amount from trade because this commodity gives the highest RCA among ASEAN-6 countries.

## 10. CONCLUSION

ASEAN-6 bring member gain from trade, this is supported with our finding which indicate that after the member join ASEAN-6 can improve their welfare according to the comparative advantage. The revealed comparative advantage that has been applied in this study shows the gain and loss from trade with respect to the complementary and substitution respectively. The results show significant on complementary which is gain from trade.

Due to the nation can create a comparative advantage trough temporary trade protection, subsidies, tax benefits and cooperative government-industry programs (Salvatore, 2001). Therefore, in order to impose the policy the government can use those strategies to maintain the comparative advantage of goods.

One important point that needs to be address is, even though ASEAN-6 countries are development countries but export industrial good instead of agriculture goods. There are two main reasons that can be address. First, according to Heckscher-Ohlin Theorem<sup>4</sup> given the assumption of the model, a country will export the commodity that intensively uses its relatively abundant factor. That insinuates that ASEAN-6 countries are labor intensive, we expect that ASEAN-6 countries will

use labor to produce the commodities in Agricultural sector. However, the result of our study indicates that ASEAN-6 export more in Industrial sector. This can be explained by "The Leontief Paradox". This theorem was first examined by Wissaily Leontief by developing a technique of accounting for all the inputs required in the production of GNP. In the case study of United State, he calculates the capital and labor requirement in the production function of the representative bundle \$ 1 million worth of both exports and import-competing goods in 1947. In that year the United State was unquestionably the most capital-abundant nation in the world and was certainly capital-abundant and labor-scare relative to the rest of the world. Thus, the expectation was exports were capital-intensive. Nevertheless, Leontief discovered that the capital-labor ratio in U.S. imports exceeded that in U.S. exports by 23 percent (Markusen, et.al, 1995). Applied in our case, ASEAN-6 countries have labor-abundant and capital-scare relative to the rest of the world. Suppose ASEAN-6 countries will export in labor-intensive, Agricultural goods. However, the results show that ASEAN-6 countries export in Industrial goods since we know that RCA represents export of commodity category by the share in the world exports of manufactured goods. Second reason is that due to free trade area the developing countries come to invest in ASEAN-6 countries. Those developing countries will invest in Industrial sectors by using the labors which is abundant in ASEAN-6 countries to produce goods. This can reduce the cost of their production because costs of labors are cheap in developing countries. Therefore, consequently that would increase in Industrial goods.

A lack of our study can be address through a weakness of the RCA index is that it measures comparative advantage purely in terms of a country's share of exports in a particular product, thereby ignoring the import side (Grimwade and Mayes 2000). If a country exports some products in a particular commodity group substantially and also imports some others in that group considerably, it can not be concluded that the country enjoys an overall comparative advantage in the product category. This is why the ratio of exports to imports (X/M) can be used to identify sectors where a country is actually strong on both the export and import side.

## References

Li, Kui-Wai. 2002. *The Gain and Loss in Export Advantage Among World Regions*.

<sup>4</sup> Markusen, J.R., Melvin, J.R., Kaempfer, W.H., Maskus, K.E., "International Trade Theory and Evidence" Chapter 8. McGraw-Hill, Inc. 1995

- www.ln.edu.hk/cpps/info/hkea2002/E0402.doc. Wikipedia, 2004. Comparative Advantage. www.peacelink.de/keyword/Comparative\_advantage.php
- Markusen, J.R., Melvin, J.R., Kaempfer, W.H., Maskus, K.E. *International Trade Theory and Evidence*. Chapter 5. McGraw-Hill, Inc. 1995.
- Salvatore, D. *International Economics*. Chapter 9. The United States of America. 2001.
- Alan, V.D., 1998. "Benefits and Costs of Flowing Comparative Advantage", The Sweetland Lnaugural Lecture, Presented at the 45<sup>th</sup> Annual Conference on the Economics Outlook, Ann Arbor, Michigan
- Xiaming.L., David. P., K. V., & Y Wei., 2000. "Change in China's Comparative Advantage in Manufacturing 1987-95", The Aston Research Centre in Asian Business & Management, Aston Business School, Aston University.
- Balassa, B. (1965), "Trade Liberalization and Revealed Comparative Advantage" *The Manchester School of Economics and Social Studies*, vol.3, No.2 (May), p.99-124.
- Petri, P.A. (1988), "Korea's export niche: Origins and prospects", *World Development*, Vol.16, No.1, 47-63.
- Yeats, A. (1989), "Shifting Patterns of Comparative Advantage: Manufactured Exports of Developing Countries", *Policy Planning and Research Working Paper* No. 165, World Bank, Washington, D.C.
- Yeats, A. (1992a), "China's Foreign Trade and Comparative Advantage: Problems, Prospects and policy implications", *World Bank Discussion Paper* No. 141, World Bank, Washington, D.C.
- Yeats, A. (1992b), "What Do Alternative Measures of Comparative Advantage Reveal About Developing Countries' Exports", *The Indian Economic Review*, Vol. XXVII, No. 2, 139
- Yeats, A. (1998), "Does Mercosur's Trade Performance Raise Concerns about the Effects of Regional Trade Arrangements", *The World Bank Economic Review*, Vol.12, No.1, 1-28.
- World Bank (1994), *China: Foreign Trade Reform*, World Bank, Washington, D.C.
- Lee, J. (1995), "Comparative Advantage in Manufacturing as a Determinant of Industrialisation: The Korean Case", *World Development*, Vol. 23, No. 7, 1195-1214.
- Hoekman, B. and Djankov, S. (1997), "Determinants of the Export Structure of Countries in Central and Eastern Europe", *The World Bank Economic Review*, Vol. 11, No. 3, 471-487.
- Rodas-Martini, P. (1998), "Intra-Industry Trade and Revealed Comparative Advantage in the Central American Common Market", *World Development*, Vol. 26, No. 2, 337-344.
- Lundberg, L. (1988), "Technology, Factor Proportions and Competitiveness", *Scandinavian Journal of Economics*, Vol. 90, No. 2, 178-188.

## GAMES ONLINE INFLUENCE AT THE CAFE ON LANGUAGE DEVELOPMENT IN CHILDREN AT KELURAHAN CEMPAKA PUTIH, CIPUTAT TIMUR, TANGERANG SELATAN

Ati Kusmawati

Muhammadiyah University of Jakarta  
Ati2051976@gmail.com

### ABSTRACT

*On line games is very interesting games for now, both from the children to adults for children this becomes especially remarkable magnetic power. Exceptionalism is what makes the kids forget him even to the associatin, the sentence they communicate very improper for the hearing. It affect their development. On line games, assualy in the cafe and there are many kinds. Surely this is the one thing that is interesting to study and thoroughly.*

*The purpose of this study was to determine the effect of online games in the cafe on the language development of children aged 9-12 years in Kelurahan Cempaka Putih, Ciputat Timur, Tangerang Selatan, that can be a source of Information to educators and parents. In addition, through this study is expected to be a stimulus for educator and parents to be more selective about the media attintion and children's games*

*This study used a qualitative descriptive approach that focuses on the effects (impact) of variotls factors, giving meaning (inter pretation) on social phenomena (miles & huberman in sunarto, 2001:135) this study collect data through observahon and depth interviews to subjects to explain and destriebe thephenomenon as well as the events that will occur in the manner described descriptif. Result of the study :1) children who play online games in the cafe often reveal abusive: 2) the situation inthe cafe were very supportive of the emergente of the use of abusive language in the presente of childern as adults that come. into play with the sentente is not good; 3) The preserle of an adult in cafe with a sentence that is not well become a huge influence for the development of children's language. 4)The child's imitation of the language of the enviroment that is created is the cafe, so that the child is easy to follow and be stimulated to destroy the child's language development .*

**Keywords:** *games online, language development in children*

### BACKGROUND

The development of information technology advancements continue to roll. One of the effects of technological progress is increasingly diverse electronic products are new that are becoming more affordable for the people especially for the upper middle. Even in the future be expanded to all levels of society. In the past some of us are very familiar with computer, laptop or mobile phone. Now many of us have it and some had several times changed HP. When we look at the surrounding environment, it is not uncommon pre-school children and elementary students who are familiar even astute play various existing applications. This means that there are social impacts that occurred in the community of the development of electronic media is happening. If we talk about the influence of electronic media on children's development, of course we need to interpret it wisely. Influence is a neutral word, which can mean good and bad. Likewise, the influence of the electronic media, of course there are good and bad effects on the development of our children.

Many different types of electronic media that could be an alternative as a medium of education because they are more interesting, there are audio and visual stimulation that can provide a real picture , more concrete, making them easier to understand children. Electronic media is very diverse. Currently, games on line is very loved electronic media by children to adults. It is very interesting games for public consumption and is the primary requirement for games addicts. It becomes interesting when his flurry of entertainment and vacation time even in kids school does take the time to play games even to forget the prayer time, eat and go home. Among the games that are often played by children that Suikoden 1, Suikoden 2, Suikoden 4, Suikoden5, Suikoden Tactics, Makai Kingdom, Disgaea 2, Sayuki, Monster Hunter, Monster Hunter 2, God of War and God of War 2. Avid children against the consumption of soft games for business people who are not in favor of moral values, education, and culture. Do not expect us to get games really educational for the kids so that it appears violence (physical or verbal) ,as well as pornography. Most of our society either because they do not understand or does not care finally 'let' her children to play games that are not

educational. In addition, provided a more varied types of games again with only paying Rp. 1000 - 3000,-/day be able to access a variety of games. With these games addiction then it will interfere with the nerves and the brain child so that the child does not want to learn, irritable, difficult to manage and the emergence of bad language. The emergence of bad language from children due to frequent playing games With these games, then there is a concern of educators and parents towards their children's learning progress. Evident from the results of studies on early childhood language development in general is quite high. The role of parents in early childhood floating language, is generally quite large, this includes : (1) early childhood language development through methods reasonably large speaking role, (2) early childhood language development through listening method huge role, (3) early childhood language development through reading great role method, (4) the development of early childhood language through great writing method perananya. And barriers experienced by older people in developing early childhood language intelligence in general is quite inhibiting. In addition, the development of children's language greatly affects associated with these games. The data is also supported by the results of the interviews have been conducted. Departing from these problems it is necessary to research on the Influence of Games On Line Against Child Language Development.

### RESEARCH PROBLEMS

To provide clear direction and operational research based on background data, the research problem can be formulated as follows:

1. Are the games on line can affect language development of children aged 9-12 years?
2. Languages such as whether that influence language development of children aged 9-12 years who are addicted to games on line?
3. How to influence games on line on language development of children aged 9-12 years inKelurahan Cempaka Putih, Ciputat Timur, Tangerang Selatan?

### RESEARCH OBJECTIVES

The aim of this study was as follows :

1. To determine the effect of the games on the line against the language development of children aged 9-12 years .
2. For parents and the researchers were able to provide clear information about the effect of the gameson the line against the language development of children aged 9-12 years .

### METHOD

This study used a qualitative descriptive approach that focuses on the effects (impact) of various factors, giving meaning (interpretation) on social phenomena (Miles & Huberman in Sunarto, 2001:135). This study focuses on the observations made when communicating early childhood, both at home and in the neighborhood around the house. Qualitative research is research that produces descriptive data in the form of words written or spoken from the people and observable behavior (Bogdan and Taylor in Moleong, 2006:4). In qualitative research, the researcher is the key instrument. Therefore, researchers must have a provision theory and insight to be able to ask, analyze, and construct the object under study becomes more apparent. Qualitative research is used if the problem is not obvious, to find the hidden meaning, to understand social interactions, to develop theory, to ensure the correctness of the data, and examine the historical development. This study used a qualitative descriptive approach that focuses on the effects ( impact ) of various factors, giving meaning (interpretation) on social phenomena (Miles & Huberman in Sunarto, 2001:135). Subjects Research : childrens aged 9-12 who were in the cafe at Kelurahan Cempaka Putih, East Ciputat Timur, Tangerang Selatan. Researchers interested in taking the age of 9-12 years because based on the observation of the authors in the field that the average user is a child of that age cafe.

Some methods of data collection in qualitative research is as follows; 1. Observation some of the information is obtained from the observation space (place), actors, activities, objects, actions, event or occurrence, timing, and feelings. The reason researchers conducted observations is to present a realistic picture of behavior or events, to answer questions, to help understand human behavior, and to evaluate which take measurements of certain aspects of the conduct feedback on these measurements. Bungin (2007 : 115) suggests some form of observations that can be used in qualitative research, namely the observation of participation, observation is not structured, and unstructured observation group. Participation observation (participant observation) data collection method is used to collect research data through observation and sensing where the observers or researchers actually involved in everyday respondents. Unstructured observation is observation that is performed without the use of local observations. In this observation the researcher or observer should be able to develop the power of observation in observing an object. Observation is the observation

group were conducted in groups against one or several objects at once. A few things to note is the observation of topography, number and duration, intensity or strength of the response, stimulus control (condition in which the emergent behavior), and quality of behavior. In this study using a structured observation as an observer develops fact-based observations made by the research subjects. Qualitative research conducted in the state of nature and nature discovery. In qualitative research, the researcher is the key instrument. Therefore, researchers must have a provision theory and insight can be asked, analyze, and construct the object under study becomes more apparent. Analysis of data is the process of systematically searching and compiling data obtained from interviews, field notes, and other materials that are easy to understand, and its findings can inform others. The analysis was done by organizing the data, translate it into units, synthesize, organize into a pattern, choose which ones are important and will be studied, and making conclusions that can be told to others (Sugiyono, 2007:334).

Analyzing of data on qualitative research such as this study has been initiated in conjunction with the collection of data for the design of both qualitative process-knit blend inseparable. Miles and Huberman (1992:14) states from the qualitative data analysis and for data collection. In collecting and analyzing data in qualitative research is an integral unity and procedurally. The data obtained appropriate research purposes, then in analyzing the data the researcher performs data reduction, sorting, and coding of data. Data were derived from interviews and documents from the village are sorted, sorted out, and coded based on the needs of this study. Necessary data are classified by the type of the problem, while not required discarded. The final activity inference. This activity aims to make interpretation of the data that was found as a reference in the research finding. 2. Interview. An interview is a conversation with a purpose. The conversation was conducted by the two parties, namely the interviewer and interviewees were asked questions that provide answers to questions that (Moleong, 2006: 186). In these interviews the researchers interviewed. 3. Taping Researchers recorded the development of language in the cafe on Cempaka Putih, Ciputat Timur, Tangerang Seatan. 4. Recording. Researchers recorded all children's language development in the cafe Cempaka Putih, Ciputat Timur, Tangerang Seatan. C. Technical Analysis Data. Techniques of data observation, interviewer, recording, and recording will be described in more detail as follows; 1) Observation in this phase, researchers analyzed the results of observations about the child's

language development after being in cafe Cempaka Putih, Ciputat Timur, Tangerang Seatan. 2) Interview. At this stage, researchers studying, collecting, and analysis of data obtained from interviews with traders and buyers. 3) Recorder based on the results of the recording, the researcher will play, learn, and analysis the data obtained in the form of child language development when they were in the cafe Cempaka Putih, Ciputat Timur, Tangerang Seatan. 4) Recording. This recording of the results, researchers classified the child's language development in the cafe Cempaka Putih, Ciputat Timur Tangerang Selatan.

## RESULT AND DISCUSSION

The study was conducted during the three months from March to May 2012. The place of research in the internet cafe in Kelurahan Cempaka Putih, Ciputat Timur, Tangerang Selatan. The results of the study were 1) Children who play games on line at the cafe often reveal abusive and less well as **pig, dog, stupid luh, damn, Anjir, stupid luh** etc ; 2) The situation in the cafe were very supportive of the emergence of language use rough due to the presence of adult children that come into play with a throw harsh words and unkind. The presence of adults will make them mimic the patterns and behaviors performed while in the cafe. In addition, they also played games that imitate because penasaaran, the bandwagon and is not slang; 3) The presence of adults in the cafe with the language they launched roughly into a huge influence for the development of children's language. 4) The child's imitation of the language of the environment that is created in the cafe so that the child is easy to follow and be stimulated to destroy the child's language development. Piaget in Mansoer Pateda (1990: 67), one of the leaders of this group said that the complex structure of the language is not something given by nature and it's not something that is learned through the environment. The structure was born and developed as a result of the continuous interaction between the child's level of cognitive functioning and the environment has been available lingualnya. Struktur naturally. Changes or language development in children will depend on the extent of involvement of the child's cognitive actively with its environment. Language learning process occurs according to a particular pattern of developmentally appropriate age. These stages include:

1. Assimilation: the process of adjustment of new knowledge with the cognitive structure.
2. Accommodation: adjustment process of cognitive structure with new knowledge.



3. Disquilibrasi: the acceptance of new knowledge that is not the same as that already known.
4. Equilibrasi: mental balancing process after a process of assimilation.

One of from the four stages are highly suited to the subject of the research is assimilation. Where when new subjects are directly diwarnet must adapt to new knowledge that is seen and played the games he saw his friend as well as a language that is spoken and heard. 9-12 years of age is the age of a child who has a high curiosity, let alone playing games is an interesting thing that they forget their lives as individuals and families like to gather with family, school, and learning. Based on the observation nd interviews with several subjects that they were happy to linger even day and prefer to play online games than eat. Given pocket money their parents use to play games online at the cafe. There is even a lie to parents. Based on interviews with the parents that their children are always playing games are very lazy to study, carry out tasks in the home, to practice, often angry and say dirty words and not educate. From the opinions of experts on language and language acquisition, especially children generally concentrated on the acquisition of more concern is felt directly in language behavior and the relationship between stimulus and response in the child, so that any behavior that appears there is no response then it happened. More over, due to frequent changes in children's language children are in place games on line and the environment shapes the child if the child does not get the attention of their parents. Environmental games on line is a very good environment for the growth of children, based on observation the author of many languages that appear not as good as the words **monyetluh, dogs, tailuh, kunyuk, aah demons**, etc. From the words mentioned is certainly not feasible and interfere with the development of their language when they are outside or in other environments and their in

labelkan be bad boy, even their parents can not educate considered.

## CONCLUSION

Games on line is a very interesting game for children aged 9-12 years. The development of on-line games is very rapid especially berjamurnya cafe around the house. Kelurahan Cempaka Putih, Ciputat Timur, Tangerang Selatan is a research point of interest, based on the observation that the games on line in the cafe is very influential on the language development of children, especially ages 9-12 years. Related to language development, this research is important to note for the parents of the child who is less of a concern, environment and communications support parents of children more intensive development of the child to be able to control both behavior and language.

## REFERENCES

- Chaer, Abdul., 2003. *Psycholinguistics, Theoretical Study*. Jakarta : PT RinekaReserved.
- Dardjowidjojo, Soenjono, 2010. *Psycholinguistics, Introduction to LanguageComprehension Humans*. Jakarta : Indonesian Torch Foundation.
- Gleason, Jean Berko and Nan Bernstein Ratner, eds., 1998. Second Edition.
- Psycholinguistics. New York: Harcourt Brace College Publishers.
- Moleong, Lexy J, 2006. *Qualitative Research Methods*, Revised Edition. London : Teen Rosdakarya.
- Sugiyono., 2007. *Educational Research Methods. Approach Quantitative, Qualitative, and R&D*. New York: Alfabeta.

## ANALYSIS OF EFFECT OF PRICE, LOCATION AND SERVICES TO INCREASE SALES VOLUME

Henny Dwijayani

Departement of Management, Faculty Economics of Universitas Darul Ulum, Jombang,  
61413, Indonesia  
hennydwija@gmail.com

### ABSTRACT

*The concept of marketing in the company is the orientation of the benefits is closely linked to the increase in sales volume. Variables that can affect, among others, price, location and service. To find out how significant the effect of several variables on the increase in sales volume can be done by analyzing the effect of the partial with multiple linear regression analysis techniques. Analysis process by assessing assessment questionnaires from respondents using a Likert scale, which is described in the statement where each item is given a score of 1 to statement 5. Then each score of each item in total the variables and analyzed with SPSS12. Based on the results of data analysis and hypothesis testing simultaneously study found that the value of F of 95.182 is greater than 0.908 F tabel. So the factor of price, location, and services simultaneously significant effect on the increase in sales volume in the B-Mart department store.*

**Keywords:** price, location, service, sales volume, Likert scale.

### 1. Introduction

The company has a goal to get a large profit as a measure of performance. The amount of profit that they got to be proportional to the volume of sales, as well as sales volume will be significantly increased. An in-depth study on the subject of net sales of the company's income statement [1], where the company has a sales volume or turnover that is likely to increase significantly,

Pricing strategy is also very important to do because the price is only one element in the various elements of the retail marketing mix that will bring in profits for the company. While other elements of cost [2]. Price is the amount of money (plus some products where possible) is needed to obtain a number of combinations and products and services [3].

### 2. Theory of price, location and volume of sales

Price is only one element in a variety of marketing mix that will bring in profits for retailers [4]. Competitive Positioning is the methods used

for the company to develop its relative position compared with competitors. If the company managed to obtain and maintain a strategic location, then it can be an effective barrier for competitors to gain access to markets

The selection of a location decision also reflects the company's long-term commitment in terms of finances, because sometimes a bad location change is difficult and very expensive. Service is any action or activity that can be offered by one party to another, which is essentially intangible and does not result in any ownership [5]. Production may be linked or not linked to a physical product. Is the behavior of producer services in order to meet the needs and desires of consumers in order to achieve customer satisfaction in itself.

Sales can also be interpreted as an attempt by man to deliver the goods for those in need. The volume of sales of goods that are sold in the form of money for a certain period of time and in it has a good service strategy [6].

### 3. Research Methods

Data processing is done in a qualitative and quantitative analysis to answer questions related to the subject under study, conducted through a survey method for data collection and analyzing the form of questions and answers through a questionnaire with a sample of 50 customers as respondents, Technical analysis of the data used is multiple linear regression analysis while the analysis process by making random sampling technique using SPSS 12. Analysis process by assessing assessment questionnaires from respondents using a Likert scale, which is described in the statement where each item is given a score of 1 to statement 5.

To examine the influence of variables jointly the location factor, product, and quality of service simultaneously on purchasing decisions, used test is the test statistic F

a. Probability  $< 0.05 = H_0$  ditolak and  $H_1$  diterima  
b. Probability  $> 0.05 = H_0$  diterima and  $H_1$  ditolak  
 $H_0: b_1 = b_2 = b_3 = 0$ , no effect of independent variables on the dependent variable. While  $H_0: b_1 \neq b_2 \neq b_3 \neq 0$ , the influences of all independent variables on the dependent variable

#### 4. Results Of The Analysis

In accordance with the model of analysis used, namely multiple linear regression, it can be analyzed by the equation:

$$Y = a + B_1X_1 + B_2X_2 + B_3X_3 + e$$

Table1. RegressionCoefficients

Model	Unstandardized coefficients		t	Sig
	B	Std Error		
a (constant)	3,412			
Harga (X <sub>1</sub> )	0,077	0,071	3,460	0,648
Lokasi (X <sub>2</sub> )	0,027	0,025	3,164	0,870
Pelayanan (X <sub>3</sub> )	0,086	0,067	3,433	0,667

Source:DataprocessedSPSS

In order to obtain a multiple regression equation coefficient values as follows:

$$Y = 3,412 + 0,077 BX_1 + 0,027 BX_2 + 0,086 BX_3 + e$$

Table 2. Summary Model

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0,928	0,912	0,903	1,20530

Source:Data processed SPSS

Value of the correlation coefficient (R) is equal to 0.928 with a coefficient value of 0.928 it indicates a close relationship between the independent variables with the dependent variable of 92.8%. While the sign of the regression coefficient indicates a positive linear relationship occurs in the same direction, meaning that the increased value of the price factor(x<sub>1</sub>), location (x<sub>2</sub>)

and services(x<sub>3</sub>), then the volume of sales will increase.

The coefficient of multiple determination (R Square) is 0.912. The coefficient indicates that the regression model used in this study were able to explain the effect of independent variables on the dependent variable was 91.2%. While the remaining 8.8% is influenced by other factors or variables that are not observed

Table 3. F test count

Change Statistics					Durbin-Watson
R Square Change	F Change	df1	df2	Sig. F Change	
0,912	95,182	3	46	0,908	1,645

Source:Data processed SPSS

The results of multiple linear regression analysis showed the results of the calculated F value of 95.182 with a 0.908 f table. While the value of the significant level (α = 0.05) with a confidence level of 95%, as calculated F is greater than 95.182 0.908 f table, then the independent variable: price (x<sub>1</sub>), location (x<sub>2</sub>), and services (x<sub>3</sub>) have influences together (simultaneously) and significant on the dependent variable, namely the increase in sales volume in the B-Mart department store.

Based on the results of data analysis and hypothesis testing simultaneously study found that the value of F of 95.182 is greater than 0.908 Ftable. So the price factor (x<sub>1</sub>), location (x<sub>2</sub>), service (x<sub>3</sub>) simultaneously significant effect on the increase in sales volume in the B-Mart department store.

#### REFERENCE

#### 5. Conclusion

Proceedings National Olympiad and International Conference  
On Education, Technology and Science (NETS) 2013  
Purwokerto, 28<sup>th</sup> December 2013

Basu Swasta, Irawan, 1993. *Manajemen Pemasaran Modern*, Liberty, Yogyakarta.

Philip dan Armstrong, Gary, 2001, *Principles of Marketing (Ninth Edition)* Prentice Hall Inc., Upper Saddle River, New Jersey.

Engel, James, 1990. (Diterjemahkan oleh Purwoko) *Satisfaction; A Behavioral Perspective On*

*The Consumer*. Mc-Graw Hill Companies Inc., USA.

Stemvelt, Robert C, 2004, (Diterjemahkan oleh Purwoko) *Perception of Service Quality*. Allyn and Bacon, Massachusetts.

## STUDY OF SELF-EFFICACY IN GRADUATE UNEMPLOYMENT

Suwarti and Ugung Dwi Ario Wibowo

Psychology Faculty of University of Muhammadiyah Purwokerto

### ABSTRACT

*After completing college, bachelor is a potential new workers. The fact shows that employment in Indonesia is still not able to accommodate all college graduates or new job seekers. While the latest data recorded educated job seekers who are still unemployed in District of Banyumas of Central Java, Indonesia, from January to April 2012 recorded of the 2997 graduate unemployment.*

*This purpose of this study was to provide answers about self-efficacy in unemployment scholars using cross sectional approach. The data were gathered from 60 bachelors as graduate unemployment. Location of research is bachelors in District Banyumas, collected through Self-Efficacy Scale. Data were analyzed by quantitative descriptive analysis using the percentage.*

*The results of the study found that validity of the scale (r) moves from 0.256 to 0.561 with the reliability test results obtained correlation alpha of 0.753. A complete overview of the graduate unemployment confidence is 1 person (1.6%) categorized as very high; 13 people (21.7%) categorized as high; 36 people (60%), 6 (10%), 4 (6.7%). It is still showing positive self-efficacy level as evidenced by the most in the category of being in the amount of 36 people (60%), with 13 people (21.7%) in the category is quite high. This suggests that although the status of the scholars are still unemployed but still has self-efficacy and passion for trying to find work.*

**Keywords :** *self-efficacy, graduate unemployment*

### INTRODUCTION

#### Background

The number of educated unemployed in Indonesia each year continues to grow, along with the inauguration of the new bachelor graduates of universities. The graduate unemployment was not only the best graduates of private universities, but also famous government universities. Indonesia central bureau of statistics (Badan Pusat Statistik or BPS) said the number of scholars in February 2007 as many as 409,900 people. A year later, in February 2008 the number of educated unemployed persons increased 216 300 or 626 200

people became. If every year increase in the average number of 216,300, in February 2013 there are more than 1 million unemployed educated. Not including unemployment of diploma were also increased steadily every year. In the span of 2007 to 2010 recorded an increase of 519,900 people, up about 57%. Unemployed graduates were largely derived from the social department noneducation, religion, and some majors inexact or MIPA (Media Indonesia, March 20, 2010).

Data from Banyumas Dinsosnaketrans were approximately the age of the workforce is unemployed about 400 thousand. The poverty rate in Banyumas in 2008 is 21.04%, or 11.56% lower than the area of performance indicators by 34.60%. If the government have no concrete steps to create a conducive business climate, this number will continue to grow naturally. While the latest data recorded educated job seekers who are still unemployed in Banyumas district from January to April 2012 recorded of the 2997 people.

Therefore, the psychological condition graduate unemployment is an important concern for further observed that the development does not bring negative effects as mentioned above. One of them is self-efficacy. Self-efficacy is a self-confidence in the ability to face challenges and trials, and to be able to achieve what people earned. Confidence will make unemployment a person who has hope and patience in trying to realize her dream, waiting for a waiting period of work, even creating better job opportunities for themselves and others.

Start from this above presentation, it is necessary to do research on the study of self-efficacy in graduate unemployment in Purwokerto.

#### Problem Statement

The fact shows that the government has not been able to address the issues surrounding the large number of job seekers (long job queuing). On the other hand termination of employment, the more incentive to grow in each company is inevitable because economic growth is still unstable. The absence of a link between university graduates with jobs available to make educated people became unemployed, which makes the university graduates are not in accordance with the needs of the community and existing businesses.

No wonder when the bachelors are still having difficulty to finding employment in accordance with the provision of knowledge they have gained.

Based on the above, the problem statement in this research is : How about self-efficacy in graduate unemployment in Purwokerto?

### Research Objectives and Benefits of Research

*This purpose of this study was to provide answers about self-efficacy in unemployment scholars in Purwokerto.*

The benefits of this research are expected to provide an overview/description of confidence of scholars who are still unemployed in the area of Purwokerto in District of Banyumas of Central Java, Indonesia. So that will be the input for local governments to make policy in order to create jobs according to the description of unemployed graduates.

### METHODS

This study used a cross sectional approach, which only take samples in accordance with the characteristics of the studied subjects. The population in this study is a good scholar diploma and sarjana graduates of public and private universities in Purwokerto, who are unemployed or in the process of looking for a job, then the samples were taken by using cluster random sampling technique, and the data collected by the scale, *collected through Self-Efficacy Scale*. Indicators of the scale, according to Bandura (1997) can be distinguished on the basis of a person's dimensions, namely: (a) the magnitude, or degree of difficulty of the task, (b) the generality, or wide field behavior; (c) strength, or steadiness/constancy against his efficacy.

The data analysis using quantitative data analysis. Quantitative data analysis was conducted to determine the description of self-efficacy which is owned by the diploma and sarjana degree are still unemployed in the area of Purwokerto. Data were analyzed by quantitative descriptive analysis and cross-tabulation percentage .

### RESULTS AND DISCUSSION

#### Results

The research activities carried out in several areas in Purwokerto in District of Banyumas of Central Java, Indonesia, on the place where jobseekers gathering information about job vacancies, such as: the Post Office; the Department

of Labor in order to make AK.1 card (reference card for jobseekers); at the police station in order to get SKCK (good citizenship certificate); events in several job fairs event.

The data collection is done by giving scale to the respondent almost 2 months, because the scale administration done one by one. Researchers conducted the data collection by visiting various places in Purwokerto. Data collection was also carried out through some friends boarding, alumni associations from various faculties.

*The data were gathered from 60 bachelors as graduate unemployment*, consisting of 35 men and 25 women. With a fairly broad age range is the range of 18 years to 33 years . The education level is also quite diverse, with Diploma-1 = 10 people; Diploma-2 = 1 person; Diploma-3 = 6 people and Sarjana = 43 people.

### Validity and Reliability Scale

Scoring of reliability and validity of the scale shows there are 20 valid items from 40 total items and 20 invalid items because of the scores fall below 0.25. In the opinion of Anwar (2004) an item stated have high validity if the value has a value of over 0.30 which can be interpreted to have a low discrimination power. However, if the number of turns pass a item insufficient then the criteria can be derived maximum limit of 0.25. So based on the criteria contained 0.25, there are 20 valid items with correlation coefficient  $r$  that moving from 0.256 to 0.561 with scale reliability test results obtained correlation Confidence alpha of 0.753.

### Categorization

#### Scale Statistics

Mean	Variance	Std. Deviation	N of Items
139,33	166,192	12,892	40

Based on Self-efficacy Scale statistical analysis obtained mean value of 139,33 with a standard deviation of 12,892. Then categorized based on the results obtained as the following options by 5 interval:

Category	Standart	Subject	%
Very High	$X > M + 1,8 \text{ SD}$ $X > 139,33 + 1,8 (12,892)$ $X > 162,536$	1	1.6
High	$M + 0,6 \text{ SD} < X \leq M + 1,8 \text{ SD}$ $139,33 + 0,6 (12,892) < X \leq 139,33 + 1,8 (12,892)$ $147,065 < X \leq 162,536$	13	21.7
Average(Considerable)	$M - 0,6 \text{ SD} < X \leq M + 0,6 \text{ SD}$ $139,33 - 0,6 (12,892) < X \leq 139,33 + 0,6 (12,892)$ $131,594 < X \leq 147,065$	36	60
Low	$M - 1,8 \text{ SD} < X \leq M - 0,6 \text{ SD}$ $139,33 - 1,8 (12,892) < X \leq 139,33 - 0,6 (12,892)$ $116,124 < X \leq 131,594$	6	10
Very Low	$X \leq M - 1,8 \text{ SD}$ $X \leq M - 1,8(12,892)$ $X \leq 116,124$	4	6.7
	Total	60	100%

## DISCUSSION

The reason that is often used against what is perceived as becoming jobseekers is embarrassed, inferior feeling to others, or fear of getting along with others (friends). The feelings can actually backfire for the individuals concerned. Because of the presence of these feelings will make individuals become emotionally unstable, tend to blame themselves or even worse with self-destructive. Feeling lazy is another manifestation of feeling insecure and afraid to do anything. Time be wasted without action and will end in regret.

Description of scholars unemployment in Purwokerto still shows considerable self-efficacy level or being proven with most being in the category (categorization table) that is equal to 36 people (60%) and 13 people (21.7%) categorized as high enough . *The results of the study found that validity of the scale (r) moves from 0.256 to 0.561 with the reliability test results obtained correlation alpha of 0.753. A complete overview of the graduate unemployment confidence is 1 person (1.6%) categorized as very high; 13 people (21.7%) categorized as high; 36 people (60%), 6 (10%), 4 (6.7%). It is still showing positive self-efficacy level as evidenced by the most in the category of being in the amount of 36 people (60%), with 13 people (21.7%) in the category is quite high. This suggests that although the status of the scholars are still unemployed but still has self-efficacy and passion for trying to find work..* This is in accordance with the opinion of UNY Graduate Research Team (2004) that there are 9 indicators of motivation that a person has:

1. Persevering in the face of the task (can work continuously for a long time and not quickly stopped before completion)

2. Resilient in the face of difficulty of quickly and do not despair.
3. Does not require external impetus to excel
4. Always strive to success and not easily satisfied with what has been achieved.
5. The desire to explore the material or a given field of knowledge.
6. Showed interest in a variety of problems
7. Happy and studious, energetic and confident in the opinion
8. Pursue long-term goals dna can delay gratification to achieve something greater,
9. Glad to find and solve problems

Based education are netted in this study the number of subjects whose sarjana (bachelor graduate)is majority subject (43 of 60 subjects or 71.7%) were unemployed or looking for work show that the existing education system has not been able to accommodate the demands of work. This is consistent with the existing phenomenon that college graduates produced in Indonesia 250,000-350,000 people per year. Of that number, about 90,000 are absorbed into the formal sector and the rest are unemployed or work in the informal sector (Hendra, 2004 ) . This indicates that a growing number of scholars it does not indicate a more prosperous country. The scholars were working in the informal sector is not as desired, but because of the circumstances that force and lack of job opportunities(source: kompasnews).

Wirutomo (1996 ) assess the number of unemployed scholars in Indonesia continues to increase due to the fact that college (universities) is unable to produce graduates that according to the market dynamics and industry advancement . so someone fresh out of college and won a college degree, the market demand has changed.

The number of graduate unemployed is still looking for a job on the other side also shows a resilience that is quite good, in the sense that there is still a desire to keep trying. As the opinion of Bandura (1994) who stated self-efficacy is the capability of a person to overcome the problems that can affect the level of stress and depression that will be experienced person when facing difficult situations and threatening. Someone who believes can address the threats or problems are and not be susceptible to interference patterns of thinking and bold face pressure and threats. Conversely, someone who unsure it can cope with the threat of experiencing high anxiety.

The data shows that there are unemployed graduates aged 33 years also can indicate a spirit to fight. According to Bandura (1986), that a person's success is largely determined by two factors, namely:

1. The presence of one strong confidence that he can realize his wish, so grab something (achievement or performance).
2. Belief that he is able to face the problems that hinder the struggle.

Self-efficacy is the belief that the individual possesses the ability to mobilize the motivation, cognitive resources and actions required above situations encountered (Bandura, 1986). Yuwono, et al (2005) stated that self-efficacy is the belief in the ability of individuals to successfully complete a particular task. Meyer (in Herwanto, 2004) expressed the belief itself as one's feelings towards her competence to succeed. Self efficacy described as a self-evaluation of one's ability or competence to display tasks, achieve goals and overcome obstacles.

Self-efficacy is an individual's belief that it has the ability to mobilize the motivation, cognitive resources and actions required above situations encountered (Bandura in NEASE, Mudgett and Quinones, 1999). Meyers (in Herwanto, 2004) defines self-efficacy as a person's feelings towards her competence to succeed. While Baron & Byrne (in Herwanto 2004) describes self-efficacy as a self-evaluation of one's ability or competence to display tasks, achieve goals and overcome obstacles.

Self-efficacy is a factor that influence the performance of a person in achieving a particular goal (Robbins, 2001). The higher a person's self-efficacy, the greater the confidence of the people against its ability to succeed in achieving the goal. High self-efficacy will also make a person more persistent when faced with challenges and more motivated when getting feedback (feedback) and negative (Bandura, in NEASE, Mudgett and Quinones, 1999).

Gist (1987) and Bandura (1991) states that a person who has self-efficacy, have faith that he is able to do any work, so it tends to have an attitude of persistence (never give up), as well as serious in doing work by deploying capabilities to the fullest. Lewan (in Al Ghifari, 2003) describes the people who have the confidence to have the characteristics of the following properties:

1. be more independent, less dependent on others,
2. able to assume responsibility given,
3. can appreciate themselves and their own business,
4. not easy to experience a sense of frustration,
5. being able to accept the challenge or new assignments,
6. have a more vivid emotion, but remained stable, and
7. able to communicate and help others.

## CONCLUSIONS AND RECOMMENDATIONS

### Conclusion

By the results of this research from the above discussion, it can be made a conclusion that describe the scholars unemployment in Purwokerto still showed positive self-efficacy level as evidenced by the most in the category of being in the amount of 36 people (60%) and 13 people (21.7%) in the category is high. This suggests that although the status of the scholars are still unemployed, but still have the self-efficacy and passion to seek work attempted. The data shows too that supported the unemployed graduates of the existing 33-year-old can indicate a conviction and have high passion to get better performance.

### Recommendation

Integrated effort between universities, government as a determinant of educational policy and industry stakeholders who will use the services of graduates jointly re-formulate a better education system. The hope is that graduates do not need to find a job in a long time and easily absorbed into the world of work.

## REFERENCES

- Al Ghifari, A. 2003. *Percaya Diri Sepanjang Hari*. Artikel. Bandung : Mujahid.
- Azwar, S. 2004. *Penyusunan Skala Psikologi*. Yogyakarta ; Andi Offset
- Bandura, Albert. 1986. *Self-Efficacy: The Exercise of Control*. New York: Freeman.



- \_\_\_\_\_. 1991. Organizational Behavior and Human Decision Process. *Journal of Academic*, vol 50, hal. 248-287
- Hurlock, E.B. 2000. *Psikologi Perkembangan Suatu Pendekatan Sepanjang Rentang Kehidupan*. Alih bahasa: Istiwidayanti dan Soedjarwo. Jakarta: Penerbit Erlangga
- Muchinsky, P.M. 1987. *Psychology Applied to Work*. Chicago: The Dorsey Press
- Rini, J.F. 2002. *Memupuk Rasa Percaya Diri*. www: e-psikologi. Com. Diakses tanggal 12 Juni 2006.
- UNY Graduate Research Team. 2004. Kurikulum Berbasis Kompetensi SMA Pedoman dan Deteksi Potensi Peserta Didik. Yogyakarta :Program Pasca Sarjana UNY. *Jip.Pdk. Jateng.go.id/Data/PEDOMAN-SMA/DETEKSI-ANAK/Pedoman Mendeteksi peserta didik, diakses 27 Mei 2006*.
- Wibowo, A. 2010. *Menyiasati Sarjana Pengangguran*. Media Indonesia. 20 Juni 2010. Mahasiswa Pascasarjana Universitas Negeri Yogyakarta Halaman 5.
- Yuwono, I, dkk. 2005. *Psikologi Industri dan Organisasi*. Surabaya: Fakultas Psikologi Universitas Airlangga

## EXISTENCE OF RURAL COMMUNITY IN THE DISSEMINATION OF AQUAPONIC TECHNOLOGY AT AGROTURISM VILLAGE

Imam Santosa<sup>1</sup>, Muslihudin<sup>2</sup>  
Taufik Budhi Pramono<sup>3</sup>

<sup>1,2</sup>Lecturer of Sociology Study Program, Faculty of Social and Political Sciences,  
Jenderal Soedirman University, Purwokerto

<sup>3</sup>Lecturer of Fishery Study Program, Faculty of Science and Engineering,  
Jenderal Soedirman University Purwokerto

Email: [Scokronegoro@yahoo.com](mailto:Scokronegoro@yahoo.com)

### ABSTRACT

*The goal of this research is aimed to find the existence of rural communities in the dissemination of aquaponic technology. The research's location is determined purposively in rural areas agrotourism of Kutasari District, Purbalingga Regency, Central Java Province. In the first phase of this research was used applied research designs. The research's result showed that farmers of rural communities have internally and externally potential for supporting dissemination of aquaponic technology. The level of success of raising the existency depend on the farmers and regional government for enlarging rural community and its local institutions in which be build. Existence villagers always important to consider in aquaponic technology dissemination process. Perceptions and responses given the villagers have a strong influence on the success of technology dissemination aquaponics devoted to the welfare of farmers in rural residents. Implication can be drawn from this, social and economic functions aquaponic technology also be a consideration for prospective adopter aquaponic technology'. With dissemination characteristics of the existing aquaponics process in rural communities in the area of agro requires awareness and mentoring functions and benefits at an early stage.*

*Keywords: existency, rural community, dissemination, aquaponic technology*

### INTRODUCTION

Poverty and under development are two phenomenon that characterize our rural communities. The ability of rural entrepreneurship is weak making it difficult to utilize every opportunity and real economic opportunities spread around. Various natural resources available in rural residents have not been optimally processed into economically valuable products. Social reality so easily found on the social structure of rural communities, including in the area of agrotourism.

Some of our laborforce are still unemployment and jobless.

Aquaponic technology is one of creative innovation management mix for increased production of environmentally friendly farming in the countryside. The results of the study Santosa, et al., (2010) showed that the dissemination of technology aquaponic able to empower the farmers in the rural economy. Peasant farmers who have adopted the technology aquaponic gained some following advantages: assuredness income, availability of family nutrition, can be managed in a narrow area and serves a diversified livelihood opportunities in the rural productive farmers. Results of research conducted by Rakocy, et al., (2006) found aquaponic technology adoption does have a double advantage: first establish the natural environment recirculation system and the second gives mutualism symbiotic relationship for fish and plants are cultivated simultaneously. Erwiantono, et al., (2009) proved that the development of suitable models aquaponik as aquaculture business optimization solutions are able to strengthen revenue and preserve natural ecosystems in Rural Samarinda, East Kalimantan. This is understandable because aquaponic technology is a combination of the two systems that work synergistically ie between hydroponics with aquaculture. Thus, aquaponic technology has a social and economic function.

For villagers in Banyumas and Purbalingga agrotourism, mix farming management- is not yet oriented on the forms of creative business income. Generally, micro business of farmers is still small scale, less business-oriented creative, less environmentally friendly and low innovation. Diversification of mix farming businesses are rarely managed to implement a public awareness for application on aquaponic technology. As a consequence, the income derived from the management of mixed farming is relatively low. To that end, there should be a study evaluating the existence of rural communities in the process of technology dissemination in the agro aquaponic.

This theme supports rural development based on local resources. The research problem is how the existence of rural communities in the dissemination of technology aquaponik?

### RESEARCH GOALS

Based on the discription above, the goal of this reseach is to review and find out how the existence of rural communities in the dissemination of aquaponic technology.

### RESEARCH METHOD

This research is a part of applied research design. This is still the first stage. This research is used a descriptive case study method with a combination of qualitative and quantitative approaches. The research's location is determined purposively in rural areas agrotourism of Kutasari District, Purbalingga Regency, Central Java Province.

Sources of research data consists of all members of rural communities living in rural sub-district Kutasari . The number of respondents was determined by census techniques. Key informants are set by using the snowball rolling .

Primary data collection techniques are performed in-depth interviews, Focus Group Discussions ( FGD ) and observation. Secondary data collection techniques to the analysis of materials on a variety of documents, articles, results of previous studies , records and other relevant literature . Data processing techniques qualitatively and quantitatively . The series of data analysis and processing activities carried on-going analysis. Data processing take place at the same time with the current data collection took place .

### RESULTS AND DISCUSSION

The village community is acommunity group that has some characteristics of a particular locality based on common bonds. Some of the traits that characterizet he presence of the villagers reflected the accumulation of homogeneity observed characteristics of individual residents of some social components follows: (1) the existence ofa relativelyhomogeneousocialnorms, (2) the trend ofliving, (3) adherence to social norms, (4) community sentiment, (5) the similarity of the perception of somet hing innovative, (6) the style of indigenous cultures and local traditions, (7) space motion autonomy, (8) the dependence on various external parties as providers of services, programs, projects and material assistance, (9) attachment on certain local institutions.

Similarly, the rural communities in the district agrotourism Kutasari has a row of special features.

Order values and social norms that are instutionalized to the structure of society shows that there is togetherness and concern among citizens for example in : mutual cooperation and social dedication in maintaining various community activities. Some of the facilities and infrastructure of the social nature of the public interest that there is in the Kutasari and Karangcegak Village known results from togetherness and communal work to meet the needs of the community both in terms of spiritual, social, economic and environmental. In each village have at least a mosque for worship means citizens. Some facilities was built in front of the citizens of the co- use of some domestic and agricultural interests . Some times, togetherness can be manifested in the development of physical facilities as such as cultivation orchard and building The Garden of Qur'an Education (TPQ) and The Space of Security Basecamp. Social values and norms, in term of togetherness concern among fellow citizens belong to the relatively high number of cases directly concerned with the problem of togetherness. This is also reflected also in faith ( belief ) that looked at a phenomenon of truth from the community's collective beliefs .

In the economic view, value of collectivity provide a strong influence on technology dissemination which offered to the peasants in managing mix farming that environmentally friendly. The use of aquaponic technology potentially increase farmers' income from monoculture farming toward multiculture farming by touching aspects of the community and training with the introduction of group technology approach will be more easily dissemination akuaponic technology, although initially still be intrigued and awareness (the cognitive aspect) residents villagers to know the importance of technology akuaponic. In the end, technology transfer aquaponic able to motivate some people to determine it as an solution to strengthen a safety valve and they will get as income generating alternatives.

Social characteristic showed that the majority of residents in the area of agro Kutasari as the food provider, fish and meat from the results their mix farming. Some members of the public have skilled to manage various types of micro-enterprises, especially in the field of agro-industry . There are also some community members who search a living as laborers / employees in industry of eyelashes. In addition, most of the other members of the community have been able to develop a good livelihood diversification in agriculture or non-agriculture . Gradually, farmers are able to conduct diversification between business management and

aquaponic technology. Both of them is very suitable to enlarge farmers capability.

Social ties among residents in the area of agro Kutasari classified as either strong category in the level of individual and group and between the same village residents. Tolerance become an important capital in term of social relationship between people and its interaction. Strong social relationships are not only found on asymmetric relation but also symmetric relationship. Asymmetrical social relationships are shown on the interaction between citizens of different villages in

socioeconomic status, but there is no social polarization among them. There are many social safety valve that connects the inter- strata . Meanwhile, there is a symmetrical relationship in the network among people who have similarities in terms of social economy status.

Residents who inhabited in the village of Kutasari generally have strong community sentiment. Some of the elements that make up the sentiments of the people in the village community and the village of Kutasari shown in Figure 1.

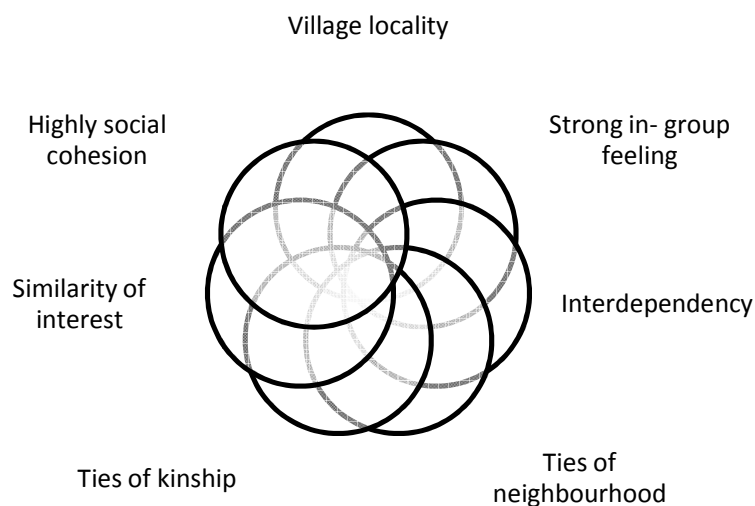


Figure1. Some Elements that Make Up The Community Sentiments of the Village of Kutasari

In the process of technology dissemination there are some elements of community sentiment that can be used as line of action for supporting participation. The power of social cohesion is a key the successfull on akuaponic technology dissemination both Karangcegak and Kutasari village.

Farmer's perception in rural communities in the village of Kutasari tend to respons positively to aquaponic technology. This has supported the dissemination process aquaponics technology to the farming community. The farmers have a similar perception on the received information. It can be indicated from social atmosphere of the following:

- a) There are similarity of thoughts that akuaponic technology has economic, social and environmental benefit.
- b) There are taste similarity that akuaponic technology as one of means of

diversification between fishery and plant cultivation with environmentally friendly.

The style of indigenous cultures and local traditions are important to be note when the process of technological dissemination to be conducted in the social structure, in the same time, it will be discovered the following signs:

- a. The relationship between personal close, intimate, familiar and patterned paternalistic.
- b. Have a basic living in agriculture world.
- c. The majority are reluctant to bear the risk for the implementation of new technologies (aquaponic).
- d. More concerned with social relationships than economically motivated relationships.

Based on the opinions Rahardjo (1999) is noted that the agrarian village communities are still concerned with personal relationships. However, the reality in Village of Kutasari showed that most

people experience a gradual transition from the traditional pattern of subsistence farming towards commercial farming patterns . The production is plucked every harvest season was sold to the village market to get a certain bill of Rupiah. Meanwhile , some other agricultural production kept for family food reserves .

Farmers life is not only effected by household economic system but also are affected by the power system at the rural government . Village administration system is effectively affected and determine social patronage in the village. However, electability a village chief was also determined by social and economic share is based on profit sharing for certain social groups. In the context of rural development in the area of agro Kutasari there are efforts to strengthen the autonomy took place for along time in various aspects . Space of autonomy in which institutionalized in term of the public interest in some of the following aspects :

- a) Economy ( institutional dues, namely "jimpitan" , gathering savings and loans ) .
- b) Social save ( fee collection for social activities such as the August 17 's, repair of village
- c) roads / mosque / prayer rooms / pos ronda / post IHC / sports field ) .
- d) Democracy (village elections / village officials and village financial management) .

Autonomy in rural Kutasari not always go smoothly . Some problems often become obstacles such as : unpreparedness community for money accumulation in raising funds and reluctant people

for participated in political activities at level of the village. Not much different, Yuliantara (2002 ) observed a wide range of complex constraints that is faced by rural community among others : ( 1 ) poverty , ( 2 ) gap and ( 3 ) injustice . To resolve the problem of village autonomy demands diverse liveliness all parties in order to attempt to induce transparency with readiness ' to sit at the same low' in order to improve the performance of village development.

Kutasari rural communities have ties dependence on various external parties as a donor / sponsor both service providers , program , project and construction material support physical and non-physical . Mutually beneficial relationship for obtaining variety of material and non-material assistance among rural communities Kutasari with various external parties take place. Citizens including farmers receive assistance in various forms such as the dissemination of akuaponic technology.

In the midst of social structure in rural Kutasari have been discovered a strong moral bond in certain local institutions . It can be indicated in various local institutional activities that are supported by people participation. Farmers and religious group are local institution that helped rural community have forum community. Both of them have social, economic and religious activities. Rural farmers have potential resources and can be classified as semi innovative in technology dissemination process. Images of the individual characteristics of farmers is on display observed on Table 1 .

**Table 1. Farmer Characteristic in The Village of Karangsari**

No.	Indicators	Information
1.	Sex	The majority of informants are men who are members of the Group of Mina Tani Maju Jaya. However, there is also a small part of this farmer group members mina which includes having the female sex.
2.	The level of Formal Education	Generally informant went to school just for able to read and write. The level of formal education in the level of primary school and junior high school. There are only a few among the informants who have been able to complete their formal education until senior high school. There are a very few number of informants who managed to attend school up to the college level / diploma two and three.
3.	Non Formal Education (In The Recently Last Years)	Non formal education theme that followed, among others: 1. Extension: aquaponic technology, mixed farming, farm management, a variety of non-rice food, the development of entrepreneurial spirit, the potential of organic agriculture, rural cooperative performance management, packaging techniques of agricultural products, cultivation of chilli, palm sugar processing, feed processing freshwater fish. 2. Training: aquaponic technology, mixed farming, farm management, a variety of non-rice food, the development of entrepreneurial spirit, the potential of organic agriculture, rural cooperative performance management, packaging techniques of agricultural products, cultivation of chilli, palm sugar processing, feed processing freshwater fish. 3.The comparative study/ "Anjang Sana" : aquaculture farming to the mix farming in Pratin

		4. Demonstration plots / demonstration ways: aquaponic technology, management of mixed farming, a variety of non-rice food,
4.	The Main Job	Most informants have main job as a farmer crop farmer ( food : rice / corn and vegetables ) as well as freshwater fish farmers . Some informants have diligently managing farming chickens and goats as a form of productive diversification in order they have income alternatives
5.	The Additional Jobs	The additional job that occupied by the informants varied. Some are looking for additional income from: trade (open small grocery shop) to sell a variety of everyday household needs), sewing services, breeder chicken / goat and construction workers.
6.	Time duration on mix farming activity	Most informants have work experience managing the mix of farm farming <2 years. There are only four informants who had experience managing the mix of farm farming > 2years.
7.	The level of income (monthly average)	Total household income per month among informant is not the same. The total income of informant start from Rp 700,000 untill Rp 2,000,000. Total income derived from farming, crops, farming of vegetables / fruit, a small farming (chicken / mutton), freshwater fish farms. Most other income derived from off-farm productive activities such as: trade, sewing services, services of construction workers.
8.	Expenditure (monthly average)	Total expenditure of informants every month start from Rp . Rp 600,000 untill Rp 1,500,000 . Expenditure allocated to fulfilment the diverse needs of families , especially : staple food , food dishes , soap / cooking oil , sugar , coffee , snacks , electricity payment, water , education , health and social contributions
9.	Sources of information for handling <i>mix farming</i>	A variety of information is mainly characterized by an increase in farming with the use of mix aquaponic technology received from the following sources : <input type="checkbox"/> General Sudirman University researchers . <input type="checkbox"/> Extension of Department of Fisheries Purbalingga . <input type="checkbox"/> Fellow farmers farmers both from the local village and outside the village
10.	Social activity	All of the informants admitted that they actively participated in a variety of social activities that take place in village
11	Agricultural land ownership	Majority of informant is still owned land itself. There are only a few people who need additional land for cultivate agricultural land , which is obtained by way of rent. In some cases, there is some informant who are work on the other land which is not owned but this land is owned by some one who are living in the other place.

Sources: To be analyse from primary data In the years of 2012

## CONCLUSION

For achieving independency, rural communities is still needed a struggle. In the midst of weakness, there are socio economic dynamic. Mutually beneficial relationship for obtaining variety of material and non-material assistance among rural communities with various external parties take place. Rural community including farmers receive assistance in various forms, such as: the dissemination of aquaponic technology. In some cases, this will be helpful but next years will make accute dependency. The level of success of raising the existency depend on the farmers and regional government for enlarging rural community and its local institutions in which be build. Existence villagers always important to consider in aquaponic technology dissemination process. Perceptions and responses given the villagers have a strong influence on the success of technology dissemination aquaponics devoted to the welfare of farmers in rural residents.

## SUGGESTIONS

Local resource potential turns out to also determine the direction of success aquaponics technology dissemination process. Social and economic functions aquaponic technology also be a consideration for prospective adopter aquaponic technology '. With dissemination characteristics of the existing aquaponics process in rural communities in the area of agro requires awareness and mentoring functions and benefits at an early stage. Potential awareness efforts are beginning initially through non-formal education, maintaining the process of change, limited adoption and eventually adoption.

## REFERENCES

- Erwiantono, Qoriah Saleha dan Sumoharjo. 2009. *Development of Aquaponic Model as Solution of Aquaculture Optimalization for Strengthening Income Society and Ecosystem*

- Sustainability in Samarinda , East Kalimantan*. Competitive Grant Research Report of Higher Education . Mulawarman University. Samarinda.
- Racocy, J.E., Losado TM, and Masser MP. 2006. *Recirculating Aquaculture Tank Production Systems: Aquaponic Integrating Fish and Plant Culture*. SRAC Publication No.454. Virginia.US.
- Rahardjo, 1999. *Introduction of Rural Sociology and Agriculture*. Gadjah Mada University Press. Yogyakarta.
- Santosa, Imam dan Rawuh Edy Priyono. 2010. *Rural Community Empowerment Through Local Resource Management of Agrotourism -Based Environmentally Friendly*. Research Report . Jenderal Soedirman University. Purwokerto.
- Yuliantara, Dadang (2002). *Village Reformation Rests on The Bottom*. Lappera Pustaka Utama. Yogyakarta.

## The Analysis of Risk and Return on the Profit-Loss Sharing Products in the Indonesian Islamic Banking Institution

**Yohani<sup>1</sup>**  
**Achmad Tohirin<sup>2</sup>**  
**Haryadi<sup>3</sup>**  
**Sobrotul Imtikhanah<sup>4</sup>**

<sup>1</sup> Lecturer at the Department of Accounting, Muhammadiyah College of Economics (STIE) of Pekalongan, Central Java, Indonesia.

<sup>2</sup> Lecturer of Islamic Finance & Economics, Post Graduate Program, Faculty of Economics, Universitas Islam Indonesia, Yogyakarta, Indonesia.

<sup>3</sup> Lecturer at the Department of Management, Faculty of Economics, Universitas Jenderal Soedirman (UNSOED), Purwokerto, Central Java, Indonesia.

<sup>4</sup> Lecturer at the Department of Accounting, Muhammadiyah College of Economics (STIE) of Pekalongan, Central Java, Indonesia

Corresponding author: Achmad Tohirin, email address: alphtin@gmail.com

### Abstract

*Profit-Loss-Sharing character is an utmost important distinction attached to the Islamic Banking Institution to replace the interest based mechanism. This paper analyzes the profile of risk and return of Islamic banking institution. The analysis focuses on products which applies the profit-loss sharing contracts. They include saving account, investment account, mudharabah financing and musharakah financing. In addition, it also accounts for equity capital. The main analysis centers on investigating whether difference on the risk and return profile of the sampled bank exist. To that end the two biggest Islamic Banks in Indonesia, PT Bank Muamalat Indonesia (BMI) and PT Bank Syariah Mandiri (BSM), are selected. The analysis is based on the annual data of these two banks covering period of 2002-2011. The simple statistical tests, two-mean difference, and correlation test, are employed to conduct the analysis.*

*The research shows that the risk and return on financing found to be not significantly different at both BMI and BSM, while the risk of mudharabah's return and the risk of return on capital at BMI found to be smaller than those at BSM. In addition, the Pearson's correlation test indicated that there is no correlation between return and risk on mudharabah financing; while for musharakah financing and equity capital, the correlations positively exist. This finding is consistent with "the high-risk-high-return principle".*

**Keywords:** Profit-Loss Sharing, Return, Risk, Financing, Equity Capital and Islamic Bank.

### I. INTRODUCTION

Islamic banks are financial intermediaries that collecting funds and distribute it in the form of deposits in the form of financing to the public to base its operational to Islamic law (Sharia), among others transactions that avoid usury, ghoror and maysir. The purpose of the ban is intended to protect parties to a transaction and guarantee that the transactions are made fulfilling the principles of justice. Islamic principles by not doing that based on the prohibition of *riba* in the Qur'an 2:275 Allah, so that the practice of Islamic banking in providing Islamic banking services facilities provide some form of trade financing (*murabaha*) and financing partnerships (*mudaraba*, *musharaka*) where the application of the markup / margin for the *murabaha* and *mudaraba* sharing system for and *musharaka*.

Unlike the conventional banks which adopt the system of interest, Islamic banks give priority to cooperation with justice so in partnership, only the halal investments only, based on the principle of profit sharing, sale, deposit and rent, which on the whole are not using the device of interest, not only on the profit-oriented, but also prosperity/falah, the relationship with the customer in the form of a partnership, not just limited to the creditor and the debtor, there is the management of zakat. In the system of interest and the sharing system is very different because the system is known to return interest rate front or ex-ante turn while sharing system return rate can only be known after the contract is executed/ex-post returns.

Unlike the conventional banks, with complex financing services tailored to the needs of its customers, each product Islamic bank has its own



unique risks that expose banks to potential losses in return for expected return. Theoretically, the known risks of financing Islamic banks smaller than conventional banks due to more stringent requirements. With interest rates so its impact is not Islamic banking market risks are small, while the liquidity risk of Islamic banks more risky because of the funds deposited. As for operational risk, legal, reputation Islamic banks are basically the same happened in conventional banks.

Returns and risks linked with each other because both are an important part of any business, as it is often used as a statement that the business that delivers high returns will have a high risk. Once the research conducted by Seref Turen (1996) whose results gets tock returns (Return on Equity) at Bahrain Islamic Bank showed lower profit with low risk compared to conventional banking, but research produced by Septiana (2008) risk is not

affect the financing and have a negative direction. Another research in Malaysia Rosly and Zaini (2008) significantly influence the risk of mudaraba in Malaysia. So the importance of analyzing the returns and risk profile of the products used in the production sharing contract sharia banking in Indonesia were finally able to assess the performance of Islamic banks.

#### Formulation of issues

The main characteristics of Islamic banking is a system of profit sharing / profit loss sharing, not just the buying and selling system, deposit and others, because the contract for the outcome which distinguishes the conventional banks as a whole, but the reality in the Islamic banking funds has been dominated by sale and purchase agreement. (table 1)

Tabel 1. Pertumbuhan pembiayaan perbankan syariah (in IDR)

Pembiayaan	Des 07	Des 08	Des 09	Des 10	Des 11
Murabahah	16.553	22.486	26.321	37.508	56.365
Mudharabah	5.578	6.205	6.597	8.631	10.229
Musyarakah	4.406	7.411	10.412	14.624	18.960
Lainnya	5.813	2.093	3.556	7.663	17.101

Sumber : Statistik Perbankan Syariah, 2011

Contract the profit sharin is closely related to returns obtained or distributed returns.

Table 2 indicates the return on the contract for the results in the last five years Islamic banking.

Tabel 2 . Imbal hasil dan margin pembiayaan pada perbankan syariah

Pembiayaan	Des 07	Des 08	Des 09	Des 10	Des 11
Murabahah	<b>21,28</b>	18,49	18,59	19,70	21,02
Mudharabah	20,77	<b>23,28</b>	15,97	<b>20,78</b>	<b>21,82</b>
Musyarakah	20,30	19,56	<b>19,22</b>	20,07	19,41

Sumber : Statistik Perbankan Syariah, 2011

By looking at reality as a whole, the Islamic banking returns of greater than mudaraba murabaha return but product revenue bercontract financing disbursed amount is much less than buying and selling products, the customer side of things as mudharibless risk because the customer not bear the loss / no bear itself for negligence but the customer does not perform the contract for the result sareless desirable customers, this is evidenced by the questions in the world of Islamic banking in particular in terms of accountability, transparency and balance, so in this research the researchers

wanted to analyze the return and risks of the products bercontract sharing on Islamic banking.

Based on the background of the issues described above, the purpose of this research was :

1. Analyzing differences in product returns bercontract for the results (savings, deposits, financing, Musharaka financing, capital) at Bank Syariah Muamalat Indonesia and Bank Syariah Mandiri
2. Analyzing differences in risk-sharing bercontract products (savings, deposits, financing, Musharaka financing, capital) at

Bank Syariah Muamalat Indonesia and Bank Syariah Mandiri

3. Analyzing the relationship of risk to returns on financing, Musharaka and capital

## II. References and hypothesis development Products using the contract of profit sharing (PLS)

Profit Loss sharing is much known by the sharing system has been widely applied in public life long ago, this is evidenced by the half-life systems / pertelon (agriculture), noise (farm), cooperatives, subcontracting is a culture of Indonesian society. The form of profit-sharing partnership bercontract there are four, namely: Mudaraba, Musharaka, muzara'ah, and Musaqoh.

Mudaraba is a joint venture contract between two parties in which the first is called Shohibul maal provides the entire capital while the second became manager. Musharaka is a partnership contract between two or more parties to a particular business in each roommates contribute capital with profit sharing agreements and personnel losses in the initial contract.

This difference actually has important implications to the financial system, in the sense that it pushes the system will be more stable because of the balance between the assets and the liabilities of the system. In addition, mudaraba deposits may actually count as equity capital similar to shareholders' funds. Based on this reasoning, it is important to consider specific institutional mechanisms for the protection of depositors mudaraba, especially if the system allows Islamic banks to coexist with conventional banks.

### Return on Islamic Banking

Returns in Islamic banks there are two types, the first Profit / Loss Sharing, a great little revenue sharing received by the customer depending on bank profits. Both Revenue Sharing, where the determination of the results will depend on the bank's gross earnings. Islamic banks in Indonesia are generally implemented Revenue Sharing system. This pattern can minimize harm to clients, only if the results are based on profit-sharing, it is a percentage of the proceeds to the customer will be much higher.

The return on Islamic banking include the return on that is distributed to customers and customer deposits and savings returns received by the bank from financing and musyarkah. In managing the fund, the bank is not responsible for losses not caused by negligence. However, if that happens is mismanagement (mismanagement), the

bank is fully responsible for such losses. By investing money in time deposits with original maturities of options one, three, six, twelve months or twenty-four months. Excess deposits are given more return than regular savings product, because deposits are savings berjangka. Imbal results distributed by banks for customers who have savings/deposits.

While the return was acceptable returns on bank financing and Musharaka financing, where the relationship between the banks and managers with the customer based on the principle of faith (trust), so that the owners of capital (shahibul maal) in principle cannot demand collateral mudharib to store any of the capital or capital gains. As opposed to basic contract principles "mandate" in the mudaraba. Although the jurisprudence does not allow capital owners/investors to demand Assurances from mudharib, in fact, Islamic banks are generally really ask for various forms of collateral, both of mudharib itself or from third parties. But they stressed that no guarantee is made to ensure the return of capital, but to ensure that the performance mudharib accordance with the terms of the contract, if it is proved that the mudharib misuse or do not really protect the goods or funds, or act contrary to the terms and qualified investors, then mudharib should be at the loss, and must grant damages in lieu.

### Islamic Banking Risk

Risk can be defined as the potential occurrence of an event (events) that may cause harm, or risk can be defined as the possibility of unwanted results, which can cause harm if not anticipated and not managed properly. In accordance with Bank Indonesia Regulation No.13/23/PBI/2011 include financing risk, market risk, liquidity risk, operational risk, legal risk, reputation risk, strategic risk, compliance risk, return and investment risk. In this research that examined risks the risk that will be faced by banks but limited financing risk and the risk of product returns bercontract the results are observed by researchers, risk financing, and equity financing musyarkah.

Habibullah (2005) evaluated through comparison murabaha return and risk by analyzing return SWBI murabaha and using the standard deviation as a measure of risk, the risk of finding a sequence of Murabahah in Islamic Bukopin from the smallest to the largest murabaha investment, working capital murabaha, murabaha consumption Halid (2007) examine the risk of murabaha with

standard models of risk measurement models and internal models, risk measurement model testing find murabaha financing at Bank Muamalat in the calculation using the standard model is greater than the internal model.

### Relationship with return risk

This research did not examine the risk offunding in terms of savings and deposits mudaraba, the only risk is measured using the coefficient of variation of returns, because basically in accordance with the concept of mudaraba, the losses are borne by the owners of capital, in this case the customer, but the customer on both banks been borne by the government because the bank have pledged savings on LPS (LPS), and therefore the risk of both of these products only compare the variation coefficient of only.

### The idea Hypothesis Formulation and Framework

Islamic Bank Muamalat Indonesia has a longer lifespan is 21 years compared with Bank Syariah Mandiri is still 14 years the Islamic Bank Muamalat Indonesia experience more. Islamic Bank Muamalat addition to the history of the establishment of a pure Islamic government without management of the bank were affected by the crisis, while the presence of Bank Syariah Mandiri comes after the financial crisis and the take over of Bank Susila Bakti is owned by PT Bank Dagang Negara and Crown Achievement fully supported by Bank Mandiri. Since the return on contract product revenue is affected by the amount of the benefits, and is therefore expected that the return is greater than Muamalat Bank Syariah Mandiri, the hypothesis associated with the return in this research was

$H_1$  : The return on the contract products for Bank Syariah Muamalat Indonesia return greater than the return contained in Bank Syariah Mandiri

Research in Malaysia and Abu Bakr Saeful (2003) concluded that the rate of return on assets of Islamic banks in Malaysia is higher with the use of Traffic overhead. Samad (1998) so the hypothesis of risk in this research are:

$H_2$  : Risk-sharing financing bercontract Bank Muamalat Indonesia is less than the risk of financing at Bank Syariah Mandiri

Research Saeful (2008), Seref Turen (1996) and Septiana (2008) in his research that examines

the factors that affect the financing murabaha and mudaraba using NPF, SWBI bonus, interest rate, and the rate of profit sharing, finding the risks indicated by the NPF but has no significant negative relationship towards the financing), Astuti (2009) found the risk of a significant effect on stock returns in Indonesia formation sector data for the time period 2007-2008, Marta (2002) found a positive effect on the risk of the stock return, so the hypothesis in this research as follows:

$H_3$  : Risk financing contract for products that have a positive outcome to return (financing, Musharaka financing, capital)

### III. METHODOLOGY

The data used are secondary data sources of financial statements of Bank Syariah Mandiri and Bank Syariah Muamalat Indonesia published. Year 2002 to 2011, is considered sufficient to keep track of the performance of the bank because the use of time series data covering the most recent period. Both Islamic banks have a lifespan of more than ten years, the two banks are the largest Islamic bank in Indonesia BSM has KPO/KC 125 and KK have a BMI of 54 and KPC number 54 and KK 129 of 343 KC and KP 220 sharia banks in Indonesia (Indonesia's banking statistics, December 2011).

#### Populasi dan Sampel

The population in this research Sharia Commercial Banks (BUS) in Indonesia, with purposive sampling techniques use the sample in consideration of Islamic Banks have a lifespan of more than ten years who have at least 50 KPO.

### IV. RESULT

#### Return on Mudharaba saving

Based on testing hypotheses regarding differences in returns on savings mudharabah Bank Syariah Muamalat Indonesia and Bank Syariah Mandiri rejected using independent t test assuming equal variances assumed with a significant level of 5%-0.0876 diiperoleh t value with  $< 1.734$  that  $H_0$  can not be rejected, thus returns mudaraba savings result in Bank Muamalat mudaraba returning savings in BSM did not differ significantly, it is obvious to the average between the two banks do not have the difference that much. only about 0.84%. It is also supported by the difference in the coefficient of variation that differed only 0.11 so it supports that return mudaraba savings on both banks did not differ significantly.

### **Return on Mudharaba Deposit**

Based on the hypothesis testing,  $t$  values obtained for  $1.0431 < 1734$  that  $H_0$  accepted, showed that the return of mudharaba deposits in Bank Muamalat compared with the return on the BSM mudharaba deposits not have the significant difference, it is obvious to the average between the two banks have the margin ranges from 0.68%, as well as supported by a margin of only 0.03 in the correlation coefficient.

### **Return on Mudharaba financing**

Based on the hypothesis test using equal variance not assumed by the value of  $t$  for  $1562 < 1734$  can be concluded that the return of financing Islamic Bank Muamalat has no difference with Syariah Mandiri Bank financing, it is obvious to the average difference between the two banks have the which is not arranged 2.67%. Based on the hypothesis test using equal variance not assumed by the value of  $t$  for  $1562 < 1734$  can be concluded that the return of financing Islamic Bank Muamalat has no difference with Syariah Mandiri Bank financing, it is obvious to the average difference between the two banks have the which is not arranged 2.67%.

Thus the return financing at Bank Muamalat compared with the return mudharaba in BSM did not have significant differences, this can be seen on an average between the two banks have the difference is only around 2.67%. This research supports research by Etty return savings and Syahril (2005). Gustin (2012) Budi (2006) which shows that state banks have no difference with the private banks.

### **Return on Musyaraka financing**

Based on the results of hypothesis testing that shows the return of Bank Muamalat Indonesia Musharaka financing is greater than the return of Bank Syariah Mandiri Musharaka financing is rejected, it is proved using the assumption of equal variances assumed  $t$  value of  $-0.313 < 1734$  that  $H_0$  accepted / not be rejected. Thus returns mudharaba deposits in Bank Muamalat returning mudharaba deposits in BSM is no different, it is obvious to the average difference between the two banks that do not have the arranged 0.36. Based on the results of hypothesis testing that shows the return of Bank Muamalat Indonesia Musharaka financing is greater than the return of Bank Syariah Mandiri Musharaka financing is rejected, it is proved using the assumption of equal variances assumed  $t$  value of  $-0.313 < 1734$  that  $H_0$  accepted / not be rejected. Thus returns mudharaba deposit in Bank Muamalat returning mudharaba deposits in

BSM is no different, it is obvious to the average difference between the two banks that do not have the arranged 0.36.

### **Return On Equity**

Based on the results of hypothesis testing using the assumption of equal variance assumed  $t$  values obtained or  $-1.9873 < 1734$  so that  $H_0$  is accepted, it is when seen on average between the two banks have the difference of 14%.

### **The risk of Mudharaba financing**

Based on the results of hypothesis testing using the assumption of equal variances assumed  $t$  value of  $0.281 > -1734$  that  $H_0$  received, indicating that the risk of financing in both banks are not significantly different, looking at the average of the two banks do not have a difference that is not much that is ranging from 0.47%. Return The risk of financing at Bank Syariah Mandiri more volatile than the risk of the return on Islamic Bank Muamalat Indonesia. Based on the results of hypothesis testing showed the return risk financing Bank Muamalat Indonesia is less than the risk of financing Bank Syariah Mandiri accepted, proven results using the assumption of equal variances assumed the probability of significance at value of  $-2.412 < -1734$ , showed that return risk financing Islamic Bank Muamalat Indonesia smaller, looks at an average of the two banks do not have a difference of 2.61%. This is because the return on Islamic Bank Muamalat Indonesia is relatively stable, although below the Bank Syariah Mandiri. Bank Syariah Mandiri seen in a previous research further increases the risk of making the return high returns, even if it resulted in better returns can be maintained.

### **The risk of Musyarakah financing**

By using the assumption of equal variances assumed  $t$  value of  $-1.306 > -1734$  so  $H_0$  received prove that Bank Muamalat Musharaka financing risk did not differ significantly within dependent Islamic Bank, looking at average risk return the two banks do not have much difference is not that amounted to 1.95%. Risk on the return on Musyarakah PT Bank Syariah Muamalat Indonesia Tbk and PT Bank Syariah Mandiri Tbk years 2002-2011.

The risk of returns Musharaka financing Islamic Bank Muamalat Indonesia diffuse than the Bank Syariah Mandiri berskisar1, except in 2002. Based on the results of hypothesis testing showed the return risk financing Bank Muamalat Indonesia

is less than the risk of financing Bank Syariah Mandiri is rejected, the results demonstrated that using the assumption of equal variances assumed significance with a probability value of 0.072 > 0.1734 so that  $H_0$  is received, it shows that the risk of musharaka financing on both banks are no different. appear on average the two banks do not have much difference is not ranged 0.04

#### **The risk of yield Return on Equity**

The results of this research strengthen the research conducted by Etty and Syahril (2005). Gustin (2012) Budi (2006). Erawati (2010) which shows that state bank have no difference with the private banks. This supports the theory that Islamic banking is not terpengaruhnya interest rate on return on capital owned. Return On Equity Bank Syariah Mandiri always very good with over Islamic Bank Muamalat Indonesia, very well with the ability of Bank Syariah Mandiri in its defense. However, the high increase in 2004 at Bank Syariah Mandiri to now make the expected risk with the risk of unbalanced reality.

#### **Return on Mudaraba financing relationship with risk financing**

By looking at the significant level of 0.079 > 0.05, indicating no correlation between the two variables, both financial risk and return risk on financing. So the hypothesis that shows the risk of financing has a positive relationship to the financing returns declined. The rejection of this hypothesis is due to the influence of other factors that affect the return of financing (beyond this research). These factors, among others due to the small portion of financing caused financing problems if there is it will reduce the returns should be accepted. In addition to the several theories that support that level of financing risk to returns is not a direct effect but indirect effect mediated by therevenue that is highly likely that other factors beyond the research effect.

#### **Musharaka financing relationship with yield risk Musharaka**

Based on the analysis conducted significant value 0.0002 at risk Musharaka return relationship, with a correlation coefficient of 0.712 indicates a positive relationship between returns with returns on Musharaka financing risk. This means that any positive effect on the increase in the level of Musharaka financing is problematic it will increase the return rate Musharaka financing. and vice versa. Sedangkan return relationships with

financing risk has no significant relationship, so that's one in the Musharaka financing that have appositve correlation between returns with return risk.

#### **Relationship risk equity with returns equity**

Based on the analysis conducted koefisien correlation obtained for 0.408. this show sthat there is a positive relationship between the return for 0.408 on Equity (ROE) on the risk of return equity. Based on the 0.408 interpretation of the correlation coefficient indicates that the correlation is supported by looking at the significant level of 0.037 < 0.05 which indicates there is no correlation between the two variables is significant. So the test accepted hypothesis is ROE against the risk equity have a positive relationship. This means that any positive effect on the increase in the ROE will increase the risk of capital. The results reinforce the hypothesis of the research conducted by Marta (2002). Besides strengthening the hypothesis that Markowitz theory shows that the higher the returns, the higher the risk.

#### **Implication**

Based on the discussion of the implications of this research are expected as follows:

1. Financial investment in both Islamic banking and savings deposits form in all Islamic banks have returns and risks of different people more aware expected to men investasikan funds to Islamic banking than traditional banking regard less of ownership and age of the bank. Islamic banking needs to socialize more optimal for customers on Islamic banking is relatively less into account for the results as the primary measure of customer knowledge, especially about the risks of losses on the distribution of funds is much less than with conventional banking, so this is the result more than the survival of Islamic banking the banking conventional.
2. More attention to Islamic banking financing due to the deposition of a few funds would be better and more beneficial to the benefit of the people in need equity, especially in the real sector in which the financing is owned less risk with more returns so will the fulfillment of sharia bermaslahah and tawazun.
3. Management of banks need to maintain return on equity which is good, and even be increased so as to increase investor confidence that will make it easier to attract capital which will increase the

market share of Islamic banking and Islamic banking being more recognized by the community with the support of the government, strong leadership, strategy development appropriate effort and adherence to the implementation of a pure Islamic banking. Management of banks need to maintain return on equity which is good, and even be increased so as to increase investor confidence that will make it easier to attract capital which will increase the market share of Islamic banking and Islamic banking being more recognized by the community with the support of the government, strong leadership, strategy development appropriate effort and adherence to the implementation of a pure Islamic banking.

## References

- Astuti .2009.*Analisis Data Panel untuk menguji Risiko terhadap Return Saham Farmasi*. Media Statistika. 2 (2). pp. 71-80. ISSN 1979-3693
- Erawati. Dewi (2010) *Perbedaan Kinerja Keuangan Perbankan menggunakan metode EAGLES antara Bank Swasta Nasional dan Bank Pemerintah periode 2007-2009*. <http://karyailmiah.um.ac.id/index.php/manajemen/article/view/10782>
- Etty Nasser dan Syahril Djaddang.2005.*Analisis Kinerja Bank Pemerintah dan Bank Swasta dengan Rasio Camel Terhadap Harga Saham*. Buletin penelitian Univ. Mercu Buana . Ed 8
- Gustin Tanggulangan (2012).*Performace Comparative of Indonesian State Bank and Private Bank*. Seminar Nasional ISSN 978-979-3649-65-8
- Habibullah .2005. *Evaluasi Pembiayaan Murabahah melalui perbandingan Return dan Risiko (studi kasus pada BUKOPIN Syariah )* tesis Universitas Indonesia
- Halid .2007. *Pengujian Model pengukuran risiko pembiayaan Murabahah (Studi kasus pada Bank Muamalat )*. tesis Universitas Indonesia
- Marta Suhardiyah.2002.*Pengaruh Price Earning Ratio dan Risikoterhadap Return Saham diperusahaan manufaktur yang terdapat dibursa efek Jakarta*. UNIPA Surabaya. www.Scribd.com
- M Syafii Antonio. 2001.*Bank Syariah dari teori dan Praktik* penerbit Tazkia Cendekia. Jakarta
- Pusat Pengkajian dan Pengembangan Ekonomi Islam ( P3EI ) UII. 2011. *Ekonomi Islam* . Rajawali Pers. Jakarta
- Septiana .2008.*Faktor-faktor yang mempengaruhi pembiayaan murabahah dan mudharabah pada perbankan syariah Indonesia*. tesis Universitas Indonesia
- Seref Turen. 1996. Performance and Risk Analysis of the Islamic Banks The case of Bahrain Islamic Bank J.KAU Islamic econ Vol. 8. pp.3-14



**UMP**

*Unggul, Modern, Islami*  
**Universitas Muhammadiyah Purwokerto**

Jl. Raya Dukuwaluh, PO BOX 202 Kembaran, Purwokerto, Jawa Tengah 53182  
Telp. (0281) 636751, 634424 | Fax. (0281) 637239  
[www.ump.ac.id](http://www.ump.ac.id)

ISBN 978-602-34930-0-7

