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The Effectiveness of Using Interactive Multimedia to Increase Students Mastery of Concept on Topic of Fluid Dynamics on Senior High School in South Halmahera Regency

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Abstract

This article is a part of research about developing multimedia of physics learning based on competence of students on senior high school in North Moluccas. This research was done to investigate the effectiveness of using interactive multimedia to increasing student mastery of concept in ability on national examination of physics particularly on concepts of Fluid Dynamics. This research was an experimental research with randomized control group pretest-posttest design which had involved the students of 11th grade at the one of senior high school in Kayoa archipelago at South Halmahera Regency. Data were collected through test which is contains national examination questions for physics lesson. The result of data analyze shown that the average N-gain for experiment group is 0.45 and control group is 0.28. The analyze of t-test shown that the scores $t_{count} = 2.529$ which is higher than the $t_{critic} = 2.0231$. Based on the calculation the effect size obtained the magnitude of effect size = 1.1 (high). Based on analyze of data, it was concluded that the use of interactive multimedia in learning of physics as significantly more effective to increase students mastery of concept in ability on national examination of physics spesially on concept of fluid dynamics than conventional learning.

INTRODUCTION

South Halmahera is one of the districts in North Moluccas Province with an area of 8148.90 km². In the north of the district is bordered by Tidore archipelago and Ternate city, while in the south bordered by Seram sea. For the east of the district is bordered by the Halmahera sea, while in the west bordered by Maluku sea.¹

South Halmahera regency is one of the districts that held a national examination at the senior high school level. National Examination (UN) is an activity for measuring the certain competencies which is achieved by learners in order to assess the achievement of national education standards were implemented nationally². Physics is one of the subjects which were tested in the national examination for senior high school especially for natural sciences program.

The results of the national examamination specially for physics on senior high school in South Halmahera regency which is identified from the results of national examinations in 2007/2008 until 2011/2012 show that the students mastery concept are still needs to be improved.

Table 1. Average Score of the Physics National Exam

Regency/ City	Average Score of the Physics National Exam				
	2007/2008	2008/2009	2009/2010	2010/2011	2011/2012
South Halmahera Regency	6.25	6.00	5.22	6.35	7.12
North Moluccas Province	6.19	5.57	5.43	6.48	7.37

National Examination Report^{3,4,5,6,7}

One of the causes of the students weakness in mastering concept on the competences which is tested in the physics national examination is the lack of availability of multimedia based on Information technology (IT) and media tutorials for trying out of national examination.^{8, 9, 10, 11, 12, 13, 14, 15}

The use of interactive multimedia is expected to be an alternative solution to support the students' mastery of concepts. Haffos defines multimedia as a computer system that consists of hardware and software that makes it easy to combine various components such as images, video, graphics, animation, sounds, text, and data which is controlled by a computer program¹⁶. As well as with these definition, Vaughn explains that multimedia is a combination of text, graphics, sound, animation and video delivered and controlled by computer¹⁷. Along with the rapid advancement of technology, Thomson defines multimedia as a system that combines pictures, video, animation, and sounds interactively¹⁶.

From these above definitions, it seems there are similarities that multimedia technologies includes a variety of media in an interactive learning software. Multimedia can be defined as technology that optimizes your computer's role as a medium that display text, sound, graphics, video, animation in an integrated and interacted¹⁶.

RESEARCH METHOD

This research used experimental method with randomized control group pretest-posttest design.

Table 2. Research Design

Group	Pretest	Treatment	Posttest
Exp. Group (R)	T ₁	Learning with using Interactive Multimedia	T ₂
Control Group (R)	T ₁	Learning with conventional model	T ₂

In this research, the populations are all students on senior high school in South Halmahera regency. While the sample were selected by using cluster random sampling technique who are the students of 11th grade at the one of senior high school in Kayoa archipelago who are spreads into two classes then were selected randomly again to be an experimental class and control class.

Data were collected through test of student competency which were tested on physics national examination especially on concept of Fluid Dynamics. While the data were analyzed using parametric statistical analysis by means of SPSS software version 16.0.

RESULTS AND DISCUSSION

Description of Student Mastery of Concept on the Topic of Fluid Dynamics

The effectiveness of using interactive multimedia to increase students mastery of concept on topic of fluid dynamics on senior high school in South Halmahera Regency are shown in table 3.

Table 3. Effect Size of using interactive multimedia to increase students mastery of concept on topic of fluid dynamics

Students' mastery of concept on topic of fluid dynamics				
	Control Group		Exp. Group	
	Pretest	Posttest	Pretest	Posttest
Mean	16.00	41.00	20.00	58.00
Std. Deviation	9.77	15.69	11.37	14.47
One-Sample Kolmogorov-Smirnov Test (Sig.)	0.298	0.202	0.597	0.246
Test of Homogeneity of Variances (Sig.)	Pretest		Posttest	
	0.345		0.615	
Independent Samples Test	t_count = 1.198		t_count = 3.592	
Effect Size	1.1 (high)			

The result of data analyze on table 3 show that using interactive multimedia in physics learning was empirically effective to increasing students mastery of concept on topic of fluid dynamics. The effect size coefficient for the increase students mastery of concept was in the high criterion ($d = 1.1$) based on Cohen's interpretation.

The percentage of the average scores pretest, posttest and N-gain for students mastery of concept on the topic of fluid dynamics are shown in Figure 1.

FIGURE 1. Profile of Students Competency Test

The average of N-gain for experimental class is 0.45 (medium) and for control class is 0.28 (low). The results of the two independent samples t -test using SPSS 16.0 with $\alpha = 0.05$ show that the score of $t_{\text{count}} = 2.529$ higher than $t_{\text{critic}} = 2.0231$. Because the t_{count} is higher than t_{critic} . So, H_0 is rejected and H_a is accepted. It means that there are any different student mastery of concept on topic of fluid dynamics between students who learned by using interactive multimedia and conventional learning are significant.

Discussion

Fluid Dynamics is one topic of physics that is on the curriculum on senior high school especially on physics curriculum for students of 11th grade. Interactive multimedia which have developed on concept of fluid dynamics can be classified on tutorial models.

Tutorials are learning guidance in the form of referrals, support, guidance and motivation for the students to learn effectively and efficiently¹⁸.

Interactive multimedia can help students to learn the subject matter. The subject matter in this multimedia presented in the form of text and pictures are equipped with sound, video and animation. With the combination of a variety of multimedia objects is expected to visualize the abstract concept of fluid dynamics so that students can be easier to be understood. In addition, students had been provided the button of label concept, so they can learn the material in accordance with their wishes. The material can be studied repeatedly in mastering concepts thoroughly.

Interactive multimedia has equipped with menu button "Instructions for Use". It is intended to provide information about how to learn if the students learn by using interactive multimedia so that they can learn more effectively and efficiently. When the students are using interactive multimedia, at first they are directed to explore the subject matter through animation and interactive simulations that had equipped with the questions, then learn the subject matter and exercises and terminated by following the evaluation. Evaluation is designed to provide feedback for students automatically when they did not mastery the concepts.

Generally the increasing of students' mastery of concepts on topic of fluid dynamics for the experimental class is better than the control class. Multimedia is media that involves multiple senses in a learning process. One of the advantages of interactive multimedia as learning media is interaction. When students apply this program, they are encouraged to obtain involved in auditory, visual and kinetic, so this involvement is made possible the information or message is easier to be understood¹⁹.

Furht states that multimedia is a combination among a variety of media; text, graphics, animation, pictures and videos¹⁶. The use of interactive multimedia can help visualize the abstract concepts such as the concept of equation of continuity for fluids, Bernoulli's Equation and its applications. The existence of this visualization, the student is expected to be easier to understand the concept.

The combination of various media on multimedia, the senses are involved when learning will become more so as the memory of students will be increased. This is consistent with the results of research Jacobs and Schade, who is stating that the memory of people who only read only gives the lowest percentage is 1%. This memory can be increased up to 25% to 30% with the help of other media such as television. Memory will increase with the use of 3-dimensional media such as multimedia up to 60% .¹⁶

CONCLUSIONS

Based on analyze of data, it was concluded that the use of interactive multimedia in learning of physics as significantly more effective to increase students mastery of concept in ability on national examination of physics specially on concept of fluid dynamics than conventional learning.

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