Effectivity of The Cooperative-Project Based Learning (CPjBL) in Enhancing HOTS of Vocational Education Students

Nizwardi Jalinus⁽¹⁾, Syahril⁽²⁾, Rahmat Azis Nabawi⁽³⁾

Engineering Faculty
Universitas Negeri Padang
Padang, Indonesia

⁽¹⁾ Jnizwardi228@gmail.com

⁽²⁾ Syahril@ft.unp.ac.id

⁽³⁾ raazna@ft.unp.ac.id

Abstract— This study intends to reveal effectivity of the cooperative-project based learning model in enhancing cognitive competencies up to the level high order thinking skills. The study was carried out experiment method using research design two-group pretest-posttest design. Based on the result of the study, the students with the implementation cooperative-project based learning model have competencies on the level high order thinking skills. Through blended of the cooperative and project-based learning, the students learn s in the groups and mutual responsibility for the success of their project tasks. Increased the students learning activities occurred during project task, the student actively improves and develop their competence in through principle of cognitivist and constructivist. With the application of their knowledge on project tasks, they get the opportunity to learn at the level of apply, analyze, evaluate and create.

Keywords—Cooperative learning, Project-Based Learning, Experimental and Control Group, Learning Outcomes, vocational education, high order thinking skills.

I. INTRODUCTION

The development of technology in the 21st century marked by the presence of industrial revolution 4.0 led to changes in the composition and competence of labour required by the world of work. Competence required is no longer a manual skill but it has been directed towards brain skills. Vocational education must respond to the dynamics that occur due to the development of this technology. Graduates of vocational education must have adaptive attitudes toward the various types of work that exist in the world of work. Revitalization of vocational education in an effort to improve the quality of learning becomes absolutely necessary for discussion. [1] Vocational Education and Training (VET) includes education and training programmes designed for typically leading to a particular job or type of job. It normally involves practical training as well as the learning of relevant theory.

All this time the vocational education is known as the more dominant education to improve and develop students'

psychomotor ability. This concept must be changed so that graduates from vocational education are in accordance the needs of the world of work in the 21st century, namely the balance between the brain skills with technical skills. The brain skills known in education terminology is the cognitive domain. The level of cognitive domain that must be owned by vocational education graduates in the 21st century is no longer at the level of low order thinking skills, but it should be at higher order thinking skills (HOTS). In the taxonomy Bloom revision Anderson and Krathwohl classification of levels that exist in HOTS is the ability to analyze, evaluate and create [2].

Development of learning in the practice of the vocational education should be continuously implemented by the educator in vocational education so that the quality of graduates in accordance with the needs of the workforce. The standard learning process that focuses on students (student centre learning) refers to the flow of a constructivism, namely to give space to students to build their own understanding of everything learned to be very appropriate to apply to learning activities. Learning strategy that teaches creative thinking such as cooperative learning, integrative learning, guided learning inquiry, mastery learning, problem-based learning, and contextual learning provides an opportunity for students to be more active in the learning process both individually and in groups. For the more dominant learning to develop the skills (psychomotor) model of project-based learning, work-based learning and teaching factory is considered more suitable to be applied.

Blending cooperative and project-based learning methods become a learning model to create learning that can improve and develop the ability of higher order student thinking skills level becomes right to developed. Each method combined into a learning model should complement each other's lack of other learning methods. [3] Models are a reflection of reality-temporary stands-ins for something more specific and real; model is helpful; in explaining that may be difficult to describe; a model may illustrate a process; a model may be a representation of something.

Cooperative learning is group learning activity organized in such a way that learning is based on the socially structured change of information between learners in the group in which each learner is held accountable for his or her own learning and is motivated to increase the learning of others [4]. This cooperative learning can be applied in almost all ages, classes, subjects and academic tasks involving high-level thinking processes, such as concept attainment, categorization, verbal and spatial problem solving, retention and memory, motor performance, predicting and judging. [5] Cooperative learning is a learning that refers to a student studying in a team to work on a task or project, where criteria must be met and each team member is individually responsible for the tasks assigned to him. The difference between cooperative learning and group work is on responsibility and partnership, when students learn cooperatively students are asked to work cooperatively, they should pay attention to group functions, prepare, plan all the work to be done together and the success of the project task also depends on the contribution of each member[6].

Project-based learning is a model that can organize projects in learning, provides opportunities for a learner-centred, collaborative learning system, learners are actively involved in solving projects independently, teamwork, and integrating problems - real and practical issues [7]. The knowledge and skills of the students develop because in the model of project-based learning students learn to create a product that is lifted from the real world [8].

The purpose of this study is to test the effectiveness of blended cooperative and project-based learning (CPjBL) in improving students' cognitive abilities at high order thinking skill (HOTS) level in energy conversion machine courses on vocational education.

II. METHOD

Before to the analysis of the student learning outcome, then first tested the requirements analysis of the test normality and homogeneity.

A. Normality Test

Normality test carried out with using Kolmogorov Smirnov statistic (Sig. > 0.05). Normality test on the pretest show on table I.

TABLE V. NORMALITY PRETEST

One-Sample Kolmogorov-Smirnov Test				
		Experiment class	Control class	
N		20	20	
Normal Mean		64,9000	63,8000	
Parameters ^{a,b} Std.		8,69301	8,07596	
Deviation				
Most Extreme Absolute		,150	,229	
Differences Positive		,129	,171	
Negative		-,150	-,229	
Kolmogorov-Smirnov Z		,672	1,023	
Asymp. Sig. (2-tailed)		,757	,247	

The result of the normality test on table I, Asymp. Sig. on the experiment class 0.757 and on the control class 0.247, the

result of the test > 0.005, it can be concluded that the pretest is normally distributed.

TABLE I. NORMALITY POSTTEST

One-Sample Kolmogorov-Smirnov Test				
		Experiment class	Control class	
N		20	20	
Normal Mean		86,1000	75,4000	
Parameters ^{a,b} Std.		5,12887	11,18458	
Deviation				
Most Extreme Absolute		,159	,154	
Differences Positive		,159	,140	
Negative		-,091	-,154	
Kolmogorov-Smirnov Z		,711	,689	
Asymp. Sig. (2-tailed)		,694	,729	

The result of the normality test on table II, Asymp. Sig. on the experiment class 0.649 and on the control class 0.729, the result of the test > 0.005, it can be concluded that the posttest is normally distributed.

B. Homogeneity Test

Homogeneity test conducted on data from the test results of students using Levene statistic. Data criteria are said to be homogeneous if significant > 0.05.

TABLE II. HOMOGENITAS PRETEST

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.
,965	3	13	,439

Based on the homogeneity test using Levene Statistic obtained the result of Sig. 0.439, which mean > 0.05. it can be concluded from the pretest data that obtained in this study have similar variance. Homogeneity test on the posttest can be seen in Table IV.

TABLE III. HOMOGENITAS POSTTEST

Test of Homogeneity of Variances			
Levene Statistic	df1	df2	Sig.
,789 ^a	4	9	,561

The result of posttest data using Levene Statistic test, the value of Sig. 0.561. It is mean higher than 0.05, it can be concluded the posttest data that obtained in this study have similar variance

C. T-test

Based on the result pretest data on the experiment and control class it can be identified and analysed, as follow:

TABLE IV. T-TEST ON THE PRETEST

Group Statistics					
	Group	N	Mean	Std. Deviation	Std. Error Mean
Result	Experiment class	20	64,9000	8,69301	1,94382
	Control class	20	63,8000	8,07596	1,80584

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Value	Equal variances assumed	,046	,831	,415	38	,681	1,10000	2,65320	-4,27112	6,47112
	Equal variances not assumed			,415	37,796	,681	1,10000	2,65320	-4,27208	6,47208

TABLE V. T-TEST ON THE POSTTEST

Group Statistics**Group Statistics**

	Group	N	Mean	Std. Deviation	Std. Error Mean
Result	Experiment	20	86,1000	5,12887	1,14685
	Control	20	75,4000	11,18458	2,50095

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Nilai	Equal variances assumed	5,922	,020	3,889	38	,000	10,70000	2,75136	5,13016	16,26984
	Equal variances not assumed			3,889	26,652	,001	10,70000	2,75136	5,05122	16,34878

The average score of the students in the experimental class is higher than the control class, in the experiment class the average student score is 86.1 and the control class is 75.4. Based on the result of posttest t-test, it is found the significance of the two classes is 0,00 which means small from 0.05, it can be concluded that there is a significant difference between learning outcome between the control class and the experimental class.

III. RESULTS AND DISCUSSION

The CPjBL model gives opportunity and experience more to the students to learn on cooperative and constructivism. At the beginning of the learning, the students learning cooperatively about teaching material of the machine of convention energy. At this stage, the students learn to level remember and understanding. Further learning activities the student learning on the project task. In the implementation of

this project task, the concept-based learning characteristics of cooperative and project-based learning combined. The material teaching that has been studied is applied to project tasks that are done cooperatively.

Based on direct observation the learning stage of project task student activities began to increase. In accordance with the CPjBL model principle is to provide space for students to be involved directly in finding the right way to solve problems from the real world by applying the knowledge that has been studied.

The students identifying the real-world problem which correspond to the machine of conversion energy course, collective information, and ask important questions about the issues raised. The results of this problem identification are analyzed together to find alternatives to solve the problem. Each of these problem-solving alternatives is evaluated

together so that they can decide the most effective method of solving.

Likewise, with the concept of energy conversion machine (project task) that they design to solve real-world problems, the students analyze each specification of the machine. Each student has a portion of each task and is evaluated together. The synergy of teamwork is crucial to the success of project work. Cooperative learning effectively promotes learning among students and improves their teamwork skills [10]. Cooperative learning is a pedagogic model based on small workgroups and interactions among students, in which students learn together to achieve common goals [11].

During the course of the project, the students made the design of the energy conversion machine in accordance with the result of the design analysis that has been formulated. The skills to create this appears at this stage, where students are able to produce something new. The achievement of students' ability at this level because at the stage of previous learning activities students have gone through all levels, such as remembering, understanding, applying, analyzing and evaluating..

IV. CONCLUSION

Based on the results of a study that has been done can be concluded that the CPjBL model is effective in improving students' ability on the cognitive domain up to HOTS level, where students are able to analyze, evaluate and create. Stages of learning in the form of the syntax of the CPjBL model organize the program of student learning activities directed to improve and develop student knowledge. Students get wider opportunities and experience because the project tasks are lifted from real-world problems and cooperative learning provides opportunities for students to learn together with their group friends to help each other develop their knowledge.

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