THE EFFECTIVENESS OF PROBLEM – BASED LEARNING (PBL) MODEL WITH HOTS ORIENTED TOWARDS THE MATHEMATICS LEARNING OUTCOMES

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ABSTRACT

High order thinking skill (HOTS)-oriented PBL learning model emphasizes the use of real problems that can entice students to think high-level in solving problems. This study aims to find more effective learning between mathematics learning using the HOTS-oriented PBL model with mathematics learning using the direct model of mathematics learning outcomes. This study population was all students of class X Muhammadiyah Vocational High School Light Vehicle Engineering 1 Bambanglipuro (SMK 1 Muhammadiyah Bambanglipuro) academic year 2017/2018, which amounted to 184 students. Samples taken by two classes using the Random Sampling technique, obtained class X Light Vehicle Engineering (TKR) F as control class and class X TKR E as experiment class. The technique of collecting data using the test method. Instrument testing uses validity test and reliability test. The data analysis technique used for the prerequisite test is the normality test with Chi-Square and homogeneity test with the F test formula, while for hypothesis test with t-test. The results showed that at a 5% significant level and dk = 56, it was concluded that (1) there was a difference in mathematics learning results among students whose learning using HOTS-oriented PBL model with students using a direct model. This is indicated by the value t_{count}= 2,8166 > t_{table}= 2,0045. (2) Mathematics learning using the HOTS-oriented PBL model is more effective than mathematics learning using a direct model of mathematics learning result. This is shown by t_{count} = 2,8166 > t_{table} = 1,6733.

Keywords: effectiveness, PBL oriented HOTS, learning outcomes.

INTRODUCTION

The rapid advancement of science and technology demands quality resources. Increasing human resources is also a prerequisite for achieving development goals; one way to improve human resources is quality education. As a determining factor for the development's success, the quality of human resources must be improved through various educational programs that are carried out systematically and directed based on interests that refer to the progress of science and technology. Law of the Republic of Indonesia, Number 20 of 2003 Article 1 Paragraph 1 concerning the National Education System, states that Education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop their potential to have spiritual, religious, self-control, personality, intelligence, noble character and skills needed by himself, society, nation, and country. Based on this, it is clear that Education is an essential requirement for humans.

Mathematics is one of the foundations in the development of science and technology. Mathematical mastery is essential to survive in the future. Mathematics is formed as a result of human thought related to ideas, processes, and reasoning (Ruseffendi in Suherman, Erman, et al, 2003: 16). Mathematics is needed to meet practical needs and solve problems in everyday life. According to Polya in Suherman, Erman et al. (2003: 91), solutions to problem-solving contain four steps of the settlement phase, namely understanding the problem, planning the solution, solving the problem according to the plan, and re-checking all the steps that have been done.

Higher-Order Thinking Skills (HOTS) are thinking skills that are more than just memorizing facts or concepts (Thomas and Thorne in Riadi, Arifin, 2016: 155) . Based on the results of PISA in 2015, Indonesia was ranked 69 out of 76 countries. The average for mathematics subjects is only 369. This means that in Indonesia, the scores on mathematics subjects are still below average. HOTS is an

output of learning outcomes. One of the things that cause poor learning outcomes is that learning is still one-way. In one-way learning, students are not allowed to use their thinking further so that when faced with questions that require higher-level thinking skills, students will find it difficult. This shows that HOTS students, in general, are still at a low level.

Based on observations at SMK Muhammadiyah 1 Bambanglipuro, it was found that the Odd Semester Mid Assessment in mathematics subjects was still low, the average grade X TKR student was still below the Minimum Completenes Criteria (MCC). Teachers are required to be able to use learning models that can stimulate the enthusiasm of all students to be actively involved in their learning experiences. One alternative learning model that can develop students' thinking skills (communication, reasoning, and connections) in problem-solving is problem-oriented learning or often known as Problem Based Learning (PBL). PBL learning models have a reasonably diverse development pattern, but learning in PBL always starts with real problems. Problem-based learning (Problem Based Learning) is also a learning approach that uses real-world problems as a context for students to learn about critical thinking and problem-solving skills and obtain essential knowledge and concepts from the subject matter (Nurhadi in Sofyan and Kokom, 2016: 263). In this study, the problem is given to students in the form of HOTS questions. In this learning model, students are more helped in increasing the ability to think at a high level in solving mathematical problems so that it is expected to improve student mathematics learning outcomes.

The purpose of this research is to find out (1) whether there is a difference in mathematics learning outcomes between students whose learning uses HOTS-oriented PBL learning models and students whose learning uses direct learning models, (2) which is more effective between learning using the learning model PBL oriented HOTS compared to learning using a direct learning model of learning outcomes in mathematics.

METHODS

This research uses a quantitative approach. The study was conducted from April 9 to April 16, 2018, at SMK Muhammadiyah 1 Bambanglipuro, Bantul Regency. This research is included in experimental research. In this study, sampling using a random sampling technique to the class. Of the six classes taken, two classes through the draw obtained class X TKR E and class X TKR F. Furthermore, between the two classes are drawn back to determine the experimental class and the control class. Obtained class X TKR F as a control class and class X TKR E as an experimental class totaling 56 students. The experimental class in learning uses the HOTS oriented PBL learning model. In contrast, the learning control class uses a direct learning model.

RESULTS AND DISCUSSION

The research results obtained in the study are:

Table 1. Acquired Mid-semester Assessment Score of the Control Class and Experiment Class

Description	Mid Semester Assessment	
	Experimentation Class	Control class
Sample	31	27
Lowest score	40	39
Highest Scores	78	76
Average	56,5484	54,9630

Table 2. Posttest Score for Experiment Class and Control Class

Description	Posttest	
	Experimentation Class	Control class
Sample	31	27
Lowest score	47	33
Highest Scores	82	76
Average	64,7903	56,3519

Table 3. Normality Test Results for Experiment Classes and Control Classes

Description	Posttest	
	Experimentation Class	Control class
Sample	31	27
χ^2_{count}	47	33
χ^2_{table}	82	76
Information	64,7903	56,3519

The homogeneity test for two free samples uses the following equation (Suparman: 52).

$$F = \frac{S_1^2}{S_2^2}$$

In testing the data variance's homogeneity with a significance level of 0.05 in the experimental class and the control class, the F_{count} value is less than the F_{table} value ($F_{count} = 0{,}7089 < F_{table} = 2{,}16$). With testing criteria, H_0 is accepted if $F_{count} < F_{table}$. Table 4 shows that the F_{count} is in the H_0 reception area; thus, the data shows the two classes sampled from a homogeneous population.

Table 4. Homogeneity Test Results

Description	Posttest	Information
F_{count}	0,7089	Homogeneous
F_{table}	2,16	

Testing the hypothesis of two parties with the criteria H_0 is rejected if $t_{count} > t_{table}$ at the real level $\alpha = 0.05$ and $df = (n_1 + n_2 - 2)$. For other prices, t is rejected. From the t distribution list, the price of $t_{table} = 2{,}0045$ while $t_{count} = 2{,}8166$. This means that H_0 is rejected, and H_1 is accepted. Thus, it can be concluded that there is a difference between learning using the PBL-oriented HOTS model and learning using a direct learning model of learning outcomes in mathematics.

One-party hypothesis testing with H_0 criteria is rejected if $t_{count} > t_{table}$ at the real level $\alpha = 0.05$ and $df = (n_1 + n_2 - 2)$. For other prices, t is rejected. From the list of t distributions, the price of $t_{table} = 2{,}0045$ while $t_{count} = 1{,}6733$. This means that H_0 is rejected, and H_1 is accepted. Thus, it can be concluded that learning using the PBL oriented HOTS learning model is more effective than learning using the direct learning model of learning outcomes in mathematics.

Both samples were given different treatments. For the experimental class, the HOTS-oriented PBL learning model was applied. In contrast, the control class applied the direct learning model. Problem-solving skills of students who use HOTS-oriented PBL learning models are more effective than students who learn by direct learning models. This is because, in the experimental class, students are grouped, each group consisting of five to six children. Then the teacher gives a problem that is presented using worksheets. The problems in worksheets contain cognitive elements C4, which means students are invited to analyze a problem to find concepts. From the problems that have been presented, the teacher asks each group to discuss and solve the problem.

The process of problem-solving in group discussions can allow students to think and discover new knowledge, besides the question and answer process carried out in the discussion can develop students' higher-order thinking skills towards higher levels of thinking. After each group finished the

discussion, the teacher asked one of the groups to present their discussion results. Then the teacher, together with students, discuss the solution to the problem and conclude the material that has been learned. After finishing, the teacher gives HOTS-oriented practice questions. In the class that uses the HOTS-oriented PBL learning model, collaboration is needed. In the control class, the direct learning model is applied. The method applied is the lecture. In this class, the teacher presents the material by only instilling the concept of materials to students. The use of lecture methods in the control class resulted in poor student mathematics learning outcomes. This is caused by the use of methods that are less effective in learning activities. Teachers more dominate learning activities, so students are less actively involved in the class. Students only accept the presentation of material given by the teacher, lack of interaction with other students, and lack of student interest in working on the given practice questions. Learning activities like these make students bored and unmotivated in learning. Meanwhile, learning using the HOTS-oriented PBL learning model is quite useful in student mathematics learning outcomes because it makes students learn more actively and develop higher-order thinking skills.

Based on the results obtained, it appears that the PBL learning model-oriented HOTS is effective in improving mathematics learning outcomes in class X TKR students in the even semester of SMK Muhammadiyah 1 Bambanglipuro, Bantul in the academic year 2017/2018.

CONCLUSION

Based on the results of research on the effectiveness of HOTS-oriented Problem Based Learning (PBL) learning models on mathematics learning outcomes in class X TKR students in the even semester of SMK Muhammadiyah 1 Bambanglipuro, Bantul district in the academic year 2017/2018 that have been conducted, the following conclusions are obtained:

1. There is a difference in learning outcomes between students who study using HOTS-oriented PBL learning models and students who use direct learning models in class X TKR students in the even semester of SMK Muhammadiyah 1 Bambanglipuro Bantul district in the academic year 2017/2018. This can be seen t_{count} = 2,8166 > t_{table}= 2,0045 at a significant level of 5% and dk = 56, so that H_0 is rejected and H_1 is accepted.
2. Mathematics learning using the HOTS-oriented PBL learning model is more effective than mathematics learning using the direct learning model of mathematics learning outcomes in class X TKR students in the even semester of SMK Muhammadiyah 1 Bambanglipuro Bantul district in the academic year 2017/2018. This can be seen t_{count} = 2,8166 > t_{table} = 1,6733 at the 5% significance level and dk = 56, so H_0 is rejected and H_1 is accepted.

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