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The Effect of Problem Based Learning on the Learning Outcomes of Motorcycle Machine Maintenance Lessons in Class XI TBSM SMK Medika Samarinda

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Abstract

This study was carried out with the following objectives: 1) to determine the difference in the significance value between the Problem Based Learning (PBL) and Conventional Learning models in the subject of Motorcycle Engine Maintenance (PMSM) for Class XI TBSM SMK Medika Samarinda; and 2) to determine the effect of the Problem Based Learning (PBL) model on the learning outcomes of the Motorcycle Engine Maintenance (PMSM) subject of Class XI TBSM SMK Medika Samarinda. This type of research is quasi-experimental with the method of dividing class groups using Non-equivalent Control Group Design. The sampling technique used an assignment random sampling technique, namely using existing classes in schools with the same conditions. Data were collected using test techniques in the form of pre-test and post-test. Then the data were analyzed using the one-way ANOVA test technique with the help of the SPSS 17.0 application. The standard of significance level used in the data analysis test is 0.05. The results showed that: 1) there were significant differences between the Problem Based Learning (PBL) and Conventional Learning models in the subject of Motorcycle Engine Maintenance (PMSM) for Class XI TBSM SMK Medika Samarinda; and 2) there is an effect of the Problem Based Learning (PBL) model on the learning outcomes of the Motorcycle Engine Maintenance (PMSM) subject of Class XI TBSM SMK Medika Samarinda.

Keywords
problem based learning; Learning outcomes; maintenance of motorcycle engines

I. Introduction

Education and technology are two things that cannot be separated in today's era of knowledge. Technology is always needed to be able to access every part of education even to the most basic level of education. Vice versa, to be able to master the science of technology requires adequate education about the technology. Especially in this day and age, almost every field of work is always in contact with technology, especially education which is needed to be able to do work in certain fields. Of course, to be able to do a job in a certain field well, one must first have provisions about the job. Talking about provisions for jobs that intersect with education and technology, means also talking about Technology and Vocational Education (PTK) which is prepared for students before entering the world of work or the industrial world.

Vocational High School (SMK) is one form of secondary level formal education that applies the principles of Technology and Vocational Education. Mukhadis (2013:2) formally clarifies the difference between engineering science as the equivalent of Engineering, and vocational science in secondary education, vocational science in higher education as the equivalent representation of Engineering Technology. In the book Section

for Education Co-operation in Asia (1982) the difference between the terms Vocational Education and Technical Education is explained as follows.

1. Vocational Education: is defined as an educational program that aims to prepare workers at the craftsman or company level at the basic level. This represents a stage of worker skill.
2. Technical Education: defined as an educational program that aims to prepare workers at the level of technicians or sub-professionals, which are usually one level above craftsman but below professional level.

Currently the era of knowledge and technology has progressed very rapidly so that the need for competent human resources in the field of work has also increased. The business world and the industrial world refer to these workers as knowledge workers (Amir, 2013: 2). Suparlan (2008 in Efendi, 2012:116) explains that SMK in Indonesia has been directed at the goal of prioritizing the preparation of students to enter the workforce and develop professional attitudes. According to Mukhadis (2013: 3) the orientation of the type of vocational education as a form of secondary education in Indonesia refers to efforts to facilitate students, especially to be ready to work in certain fields of work. So that the learning outcomes obtained must be oriented to the chosen area of expertise.

Based on the Core Competencies and Basic Competencies (KI & KD) for SMK/MAK that KI & KD Competencies of Motorcycle Engineering & Business Skills in the Class XI Motorcycle Engine Maintenance (PMSM) subject, as follows:

Table 1. KI & KD PMSM Class XI TBSM

CORE COMPETENCIES		**BASIC COMPETENCIES**	
3.1	Understand the working principle of valve mechanisms	4.1	Regular maintenance of the valve mechanism
3.2	Understand the working principle of lubrication systems	4.2	Regular maintenance of the lubrication system
3.3	Understand the working principle of the cooling system	4.3	Regular maintenance of the cooling system
3.4	Understand the working principle of the intake and exhaust system	4.4	Regularly maintain the intake and exhaust system
3.5	Understand the working principle of the carburetor gasoline fuel system	4.5	Regularly maintain the carburetor gasoline fuel system
3.6	Understand the working principle of the gasoline injection system	4.6	Regular maintenance of the gasoline injection system
3.7	Understand the working principle of manual transmission system	4.7	Regular maintenance of the manual transmission system
3.8	Understand the working principle of automatic transmission system	4.8	Regular maintenance of the automatic transmission system
3.9	Applying manual clutch system maintenance	4.9	Periodically maintain the manual clutch system
3.10	Applying how to maintain the automatic clutch system	4.10	Regular maintenance of the automatic clutch system

According to Mukhadis (2013:3) "the orientation of the type of vocational education as a form of secondary education in Indonesia refers to efforts to facilitate students, especially to be ready to work in certain fields of work". The main purpose of Vocational Schools according to the National Education System Law article 15 (in Wulandari and Surjono, 2013:179) is to prepare students to become productive human beings, able to

work independently, fill job vacancies in the business world and the industrial world as middle-level workers in accordance with competence in chosen program of expertise. In accordance with the 2006 Edition of the Vocational School Curriculum (2006:6) that "SMK organizes education and training (training) in various skill programs tailored to the needs of the workforce. The expertise program is grouped into areas of expertise according to the industry/business/profession field group. To be able to meet these goals, the learning process in Vocational High Schools must be able to represent the situation in DU/DI and in accordance with the principles of "learning by doing" vocational education and special justification for real needs in the field. But what is happening now is that learning in almost every vocational school is far from the principles of vocational education that should be.

Good & Brophy (1990, in Hariyanto, 2012:46) argues about learning outcomes stating that learning is a process or interaction that is carried out by someone in obtaining something new in the form of behavioral changes as a result of the experiences themselves. These behavioral changes will appear in students' mastery of new patterns of responses to their environment in the form of skills, habits, attitudes, abilities, knowledge, understanding. , emotion (emotional), appreciation (appreciation), physical, and ethics or character as well as social relations. Reigeluth (in Keller, 1983:397) argues that learning outcomes are all effects that can be used as indicators of the value of using a method under different conditions. There are at least four indicators that can be used to see the effectiveness of a lesson: (1) accuracy in mastering behavior; (2) accuracy of performance; (3) suitability of performance; and (4) the quantity of performance (Degeng, 1989:19). Learning outcomes at Vocational High Schools as stated in Article 15 of the National Education System Law are specifically aimed at preparing students to work in certain fields. Degeng (1989:19) explains that learning outcomes usually follow certain lessons that must be associated with achieving the goals that have been set. So that the learning process carried out must be able to represent the conditions in the world of work in order to achieve the learning objectives that have been set.

Vocational High School students are required to be able to master the competencies in these training subjects, so an effective learning process is needed to be able to achieve these goals. The use of the right learning model can determine the effectiveness of the learning process carried out, in order to help students explore their potential and master the competencies needed in DU/DI. Amir (2009:4) argues that learners of the current era of knowledge need something more than just a learning process with an educator-centered approach. Namely, by using an approach that can provide the competencies, knowledge, and a series of skills needed from time to time. Talking about the learning process, recently more and more educational institution managers are realizing the need for learner-centered learning. According to Ching & Gallow (2000, in Amir, 2009:3) that teaching-centered learning (teacher centered), namely lectures are considered traditional and need to be changed. This is because the lecture method is not able to fully represent the situation in DU/DI, so students are only able to imagine what reality is like in DU/DI.

The application of the lecture method which only transfers knowledge from the teacher's head to the student's head in a productive training eye is actually confusing for vocational students in absorbing the knowledge given. Because productive training courses are designed according to the situation in DU/DI and vocational students need to feel, at least be able to represent, the real situation, pressure, and problems that exist in DU/DI. Students are forced to "swallow" all the information provided by the teacher, so that it does not provide space for students' abilities and creativity to develop, especially in solving a problem. In addition, the use of the lecture method for SMK students seems monotonous

and boring, making it easy for students to lose enthusiasm in learning. This of course can hinder the achievement of the main goal of SMK to produce work-ready graduates who are skilled, educated, full of creativity, and have broad insight in their fields.

Based on this, the researchers tried to apply a new learning model that is expected to be more effective than conventional learning models in order to improve the quality of learning and students' thinking power, and so that students feel and get used to how to deal with problems that will be encountered in DU/DI later. The learning model that researchers will try to implement is the Problem-Based Learning (PBM) model. Problem Based Learning (PBM) or commonly referred to as Problem Based Learning (PBL) is defined by Mukhadis (2006) as a learning strategy in a real-life context that is oriented towards problem solving and developing critical, synthetic, and practical thinking by utilizing multiple intelligences to get used to learning how to learn. Through PBM, students are given concrete problems that are oriented to solving these problems in order to invite students to construct knowledge actively and independently. This is useful for improving students' abilities in adaptation, problem solving, making rational considerations, taking a comprehensive and universal approach to a problem, developing empathy, and working in teams, all of which are relatively needed for DU/DI.

In this study, the Problem-Based Learning model applied to students used the open-ended problem method, in which each problem given to students had more than one solution and the correct answer. "Lessons using open-ended problem solving emphasize the process of problem solving activities rather than focusing on the result" (Shimada & Becker, 1997 in Foong, 2000). The application of open-ended problem PBM in Gasoline Motor Technology training courses allows students to find various solutions to each problem, thereby providing students with opportunities to develop students' mindsets towards a problem gradually. In addition, it also allows students to feel how the conditions and pressures are in solving problems that are usually encountered in DU/DI.

II. Research Methods

This type of research is quantitative research with a quasi-experimental design (quasi-experimental). The method applied in this research is the Non-equivalent Control Group Design to test the effect of the Problem Based Learning (PBL) model on the learning outcomes of Class XI TBSM students in the subject of Motorcycle Engine Maintenance (PMSM). The independent variable in this study is the Problem Based Learning (PBL) model and the dependent variable is the learning outcomes of Class XI TBSM students at SMK Medika Samarinda in the subject of Motorcycle Engine Maintenance (PMSM). And the variables to be controlled are teachers, learning materials, time allocation, place, learning media and the environment in which these variables are controlled. The nature of the control variable is constant or cannot be influenced by external factors that are not included in the research process. The design pattern applied in this study is as follows:

Table 2. Research Design

Group	***Pre-Test***	**Treatment**	***Post-Test***
Experiment	O_1	X_1	O_2
Control	O_1	X_2	O_2

Information:
O1 : Pre-test
X1 : Implementation of problem based learning (PBL) model
X2 : Application of Conventional Learning model
O2 : Posttest

The population selected in this study were students of class XI Motorcycle Engineering & Business at SMK Medika Samarinda, amounting to 254 people. The sample selected there are two classes, namely class XI O1 totaling 48 people and class XI O2 totaling 45 people. However, because half of class XI O1 and class XI O2 carried out PSG, the sample was reduced to class XI TBSM A totaling 23 people and class XI TBSM B totaling 23 people. The samples that have been taken were divided into a control group and an experimental group. The sampling technique used is assignment random sampling, which is using existing class groups. Assignment random sampling technique was used with the consideration that the determination of the experimental group and control group could not be done by random random individuals, but by random groups (Mukhadis, 2003:61).

The research instrument used is divided into two, namely the treatment instrument and the measurement instrument. The treatment instrument is the application of Problem Based Learning (PBL) and Conventional Learning models, along with the learning tools. The measurement instrument is in the form of a learning outcome test. Before being used for research, a test of the learning outcomes test instrument was conducted to 10 students of class XII. The learning outcomes test instrument used for the trial amounted to 25 items. After the learning outcomes test instrument was tested on students, the validity and reliability tests were carried out on the learning outcomes test instrument. The results of the validity test using the Pearson Product Moment method showed as many as 21 valid items and the reliability test using the Alpha-Cronbach method showed the number 0.955, so it can be concluded that the learning outcomes test instrument is valid.

Hypothesis testing was carried out using a two-way ANOVA test to determine the significance level of the average difference in learning outcomes for Motorcycle Engine Maintenance (PMSM) in each research subject. Before testing the hypothesis, a prerequisite test was carried out on the data consisting of a normality test and a homogeneity test. The normality test using the Kolmogorov-Smirnov method showed that the data on learning outcomes and intelligence levels were normally distributed. The homogeneity test using Levene's method shows that the data on learning outcomes and intelligence levels are homogeneous. Two-way ANOVA test using the General Linear Model: Univariate method was carried out using SPSS 17.0 with a significance level of 0.05. Ha is accepted if the significance value (Sig.) is above 0.05, and Ha is rejected if the significance value (Sig.) is below 0.05.

III. Results and Discussion

Before entering into the results of research and discussion after analyzing the data on the learning outcomes of the Problem Based Learning (PBL) model, it is necessary to first know the data on the initial learning outcomes before students are treated with the Problem Based Learning (PBL) model. The data was obtained through a pre-test in which both groups of students were given questions with the same number and criteria. The results of the pre-test were obtained as follows:

Table 3. Early Data on Student Abilities

Group	**Value Maks.**	**Value Min.**	**Average**	**Standard Deviation**
Experiment Class	80.00	28.00	60.87	13.696
Control Class	68.00	36.00	49.00	10.954

The results of the analysis of student learning outcomes using the Problem Based Learning (PBL) model obtained an average score of 71.48 with the highest score being 88 and the lowest score being 44. In addition, the percentage of scores obtained by students was also 21.7%. are in the very good category, 39.1% of the students are in the good category, 21.7% of the students are in the sufficient category, and 17.3% of the students are in the poor category. The results of the analysis of student learning outcomes using the Conventional Learning model obtained an average score of 61.74 with the highest score being 84 and the lowest score being 48. In addition, the percentage of scores obtained by students was also obtained where 4.3% of students were in the good category. once, 34.7% of students in the good category, 21.7% of students in the sufficient category, and 39.1% of students in the poor category.

Table 4. Student Learning Outcomes Based on Learning Model

Learning Model	**Maximum Value**	**Minimum Value**	**Average**	**Standard Deviation**
Problem Based Learning	88,0	44,0	71,48	13,118
Conventional Learning	84,0	48,0	61,74	11,494

The first hypothesis to be tested is:

1. H_a: There is a difference in the significance value between the Problem Based Learning (PBL) and Conventional Learning models in the Motorcycle Engine Maintenance (PMSM) subject for Class XI TBSM SMK Medika Samarinda.
2. H_o: There is no difference in the significance value between the Problem Based Learning (PBL) and Conventional Learning models in the subject of Motorcycle Engine Maintenance (PMSM) for Class XI TBSM SMK Medika Samarinda.

The results of hypothesis testing obtained Fcount of 4.387 and Sig. of 0.043, so Ho is rejected. These results can be interpreted that there is a significant difference in learning outcomes between the group of class XI TBSM students who are taught using the Problem Based Learning (PBL) model and the group of class XI TBSM students who are taught using the Conventional Learning model on the subject of Motorcycle Engine Maintenance at SMK Medika Samarinda.

The second hypothesis to be tested is:

1. H_a: There is an effect of the Problem Based Learning (PBL) model on the learning outcomes of the Motorcycle Engine Maintenance (PMSM) subject of Class XI TBSM SMK Medika Samarinda.
2. H_o: There is no effect of the Problem Based Learning (PBL) model on the learning outcomes of Motorcycle Engine Maintenance (PMSM) subjects for Class XI TBSM SMK Medika Samarinda.

Based on the results of the hypothesis test which shows a significance value of d below 0.05, which is 0.043, it can be concluded that the Problem Based Learning model has an influence on learning outcomes in the subject of Motorcycle Engine Maintenance (PMSM) students of Class XI TBSM SMK Medika Samarinda, when compared with the Conventional Learning model. Graphically, the difference in the scores of the Experimental Class and Control Class students can be described as follows:

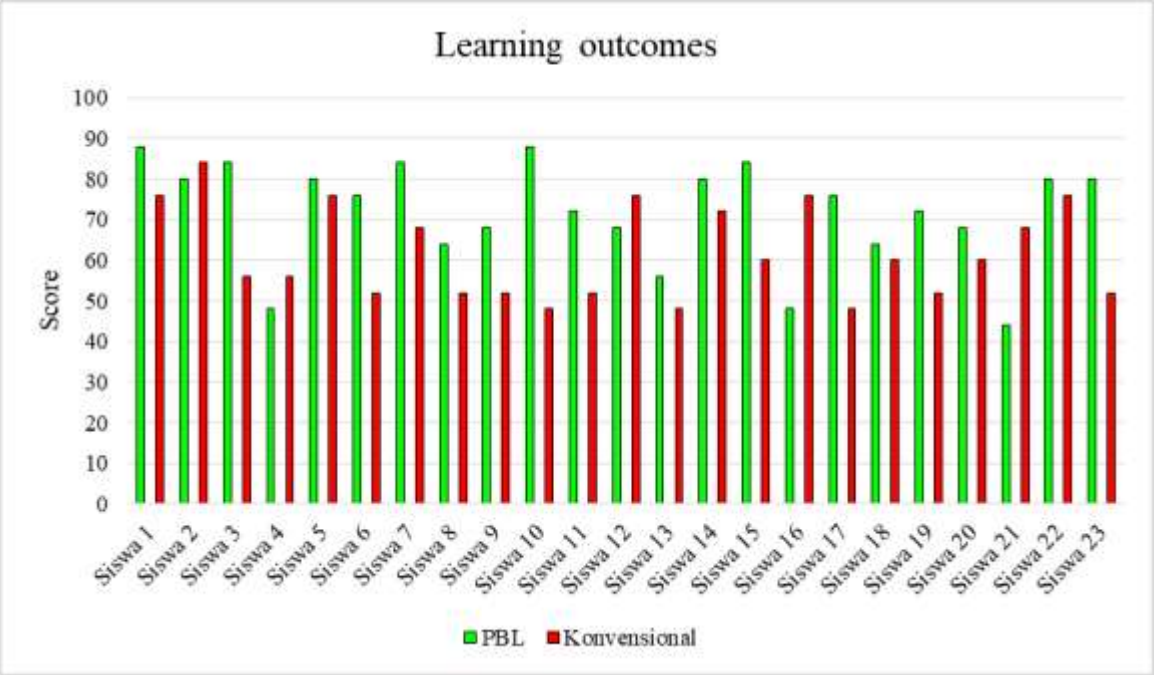

Figure 1. *Comparison of Learning Outcomes*

The results of this study indicate that the Problem Based Learning (PBL) model provides a positive contribution to student learning outcomes in the Motorcycle Engine Maintenance (PMSM) training course. The application of the Problem Based Learning (PBL) model can arouse students' curiosity and curiosity about a problem given to them. Through observations made by researchers during the implementation of Problem Based Learning (PBL), researchers found that through this curiosity students' motivation could be increased to find out how to solve the problems given to them. The application of the Problem Based Learning (PBL) model that uses several small groups makes it easier for students to share ideas and opinions, as well as train students to be able to work in teams well. The Problem Based Learning (PBL) model also helps students to construct the knowledge they already have with the new knowledge they learn independently, so that students better understand the knowledge gained by finding it themselves. This is evidenced by the presentation of reports by student representatives from each group where each presentation has a different style and language in solving the given problem.

While Problem Based Learning (PBL) is a learner centered learning model, the Conventional Learning model is a teacher centered learning model. Teachers are considered as the only source of knowledge and information needed by students. This causes students to be passive in exploring and seeking the knowledge they need, so that the understanding that students get of a knowledge will never be deep. That is, intelligence and intelligence will not increase much. Tannenbaum & Schmidt (1973) and Goom & Elden (2004 in Amir, 2009:7) explain where the centralized learning process should be in the form of pictures called the Pedagogical Continuum (Pedagogical Continuum) as follows:

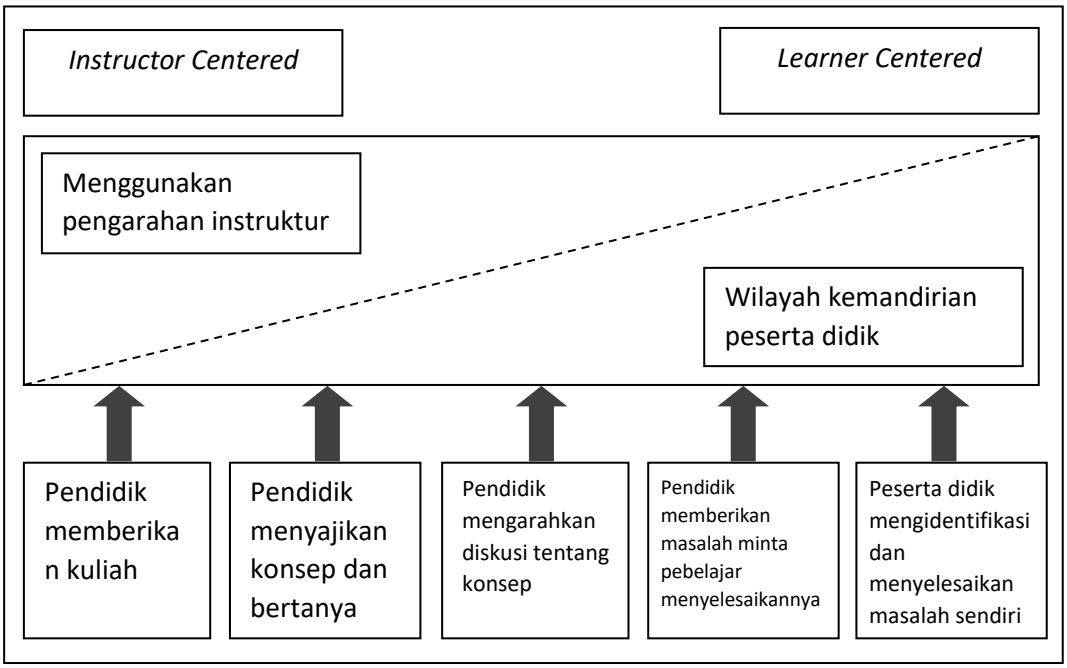

Figure 2. *Pedagogical Continuum of Problem Based Learning Model (PBL)*

The Pedagogic Continuum illustrates that teacher-centered learning causes students to become passive as listeners and recipients of information, so that the area of student learning independence becomes very narrow. In contrast to student-centered learning where the teacher provides little information, then the teacher provides problems for students to discuss and solve independently. This causes students' learning independence to be in a wide area. The Problem Based Learning (PBL) model which is a student-centered learning model has every component on the Pedagogic Continuum that can bring students to the level of student independence in identifying, conceptualizing, and solving problems.

IV. Conclusion

Based on the results of the research and discussion, the following conclusions can be drawn:

1. The learning outcomes of the subject of Motorcycle Engine Maintenance (PMSM) for Class XI TBSM students using the Problem Based Learning (PBL) model were better than the learning outcomes for Class XI TBSM students using the Conventional Learning model. The research was conducted on the Problem Based Learning (PBL) model to find out how big the significance value is in the Problem Based Learning (PBL) model, with the aim of the Problem Based Learning (PBL) model being a better alternative and suitable to be applied at SMK Medika Samarinda, in addition to Conventional Learning models that have been applied previously.
2. The Problem Based Learning (PBL) model has an influence in improving and improving student learning outcomes of Class XI TBSM SMK Medika Samarinda on the subject of Motorcycle Engine Maintenance (PMSM) when compared to the Conventional Learning model with significant results. Problem Based Learning (PBL) model can arouse students' curiosity in solving problems given through observation, identification, analysis, and discussion methods so that it can be applied to learning effectively.

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