

THE EFFECT OF PROBLEM BASED LEARNING TO STUDENTS' MATHEMATICAL PROBLEM SOLVING ABILITY

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ABSTRACT

This study aims to determine the effect of problem based learning to students' mathematical problem solving ability. This study is a quasi-experimental research. The study population is all students of class VIII MTs Al-Yusriyah. The sample in this study were two classes, VIII-A which is used as the experimental class and class VIII-B used as a control group. The instrument used was a test in the form of descriptions which have validated. From the hypothesis testing $t(2.988) > t \text{ table}(1.684)$ means H_0 rejected and H_a accepted. It shows there is a problem-based learning model effect on students' mathematical problem solving ability.

Keyword : Problem Based Learning Model, Mathematical Problem Solving Ability

1. INTRODUCTION

Math is an important subject, there are a lot of activities that related to mathematics. Mathematics is one of the most subjects lessons that given from the primary education to the higher education. The purpose of learning mathematics, such as: "(1) understanding the mathematical concept, explain the link between concept and apply the concepts or algorithms in a flexible, accurate, efficient and remain in fragment problem, (2) using the reasoning in the patterns and nature, perform mathematical manipulation in making generalization, compile evidence or explain the ideas and accomplishments of mathematics, (3) solving problems that include the capability of understanding the problem, devised a mathematical model, solve the model and find a solution, (4) communicate ideas mathematics with symbols, diagrams or other media to clarify the situation or problem, (5) having an attitude appreciate the usefulness of mathematics in life, are curious attention and interest in studying mathematics and tenacious attitude and confidence in problem solving "(Depdiknas, 2006).[4]

However, in fact from various fields of existing studies, mathematics is a lesson that is considered of difficulty and intimidating for students in school. This can lead to the poor mathematical ability of students. Though mathematical ability must be owned by a person in order to create a learning mathematics and mathematics achievement of learning objectives. One of the important skills students need to have in learning mathematics is problem solving abilities. Pehkonen (2007)[9] says that solving the problem is generally accepted as a meaning to promote the ability to think. According to Russefendi (1991) [12], problems in mathematics is something that be able to solve the problem without using a routine method or algorithm by himself. A problem can be defined as a situation where a person asked to resolve the issue that has not been done and do not understand the solution. The problem arises when a person faces a tricky thing, is conflict, and deviate from the usual situations. A person can solve problems in life if he has the skills and ability to think about the problems derived from his own experience. Solving the problem

is the way to solve problems. Gagne (in Hasratuddin, 2015) [15] says that solving the problem is the process of synthesizing a variety of concepts, rules, or formulas to find a solution to a problem. In line with Senthamarai, Sivapragasam, Senthilkumar (2015) [13] suggests the problem-solving ability is the ability to understand what the purpose of a problem what are the rules that can be applied to represent in solving problems. NCTM (2000) [7] standard formulate mathematical problem solving. The formula outlines the mathematical learning should enable students to: (a) establish her new knowledge through problem solving; (b) apply and adapt a variety of strategies corresponding to solve the problem; (c) monitor and reflect on the process of mathematical problem solving; and (d) solve problems that arise from mathematics or other disciplines. So by solving math problems, students with the help of a group and / or teachers to build new mathematical knowledge for him while learning to use strategies to solve problems based on their existing knowledge. In this context NCTM (2000) [7] regard that problem-solving as a process to build knowledge. According to Polya (1973) [10], a solution containing about 4-step problem solving completion phases, namely: (a) Identify / understand the problem, (b) Plan settlement, (c) Implement the settlement plan, (d) Re-check the results.

However, based on the observations in MTs Al-Yusriyah, students have a low mathematical problem-solving ability . It will have an impact on student's ability to learn mathematics. This is also consist with the fact of rank students Indonesia in math. It can be seen from the results of PISA report (OECD, 2016)[8] in 2015 concluded that the ranking of mathematics students in Indonesia were taken as the sample was ranked 63rd out of 69 countries that participated. One of the factors that can cause low mathematical solving ability of students is learning. Students tend to be passive, mostly working on the problems that routine and do not understand what is meant in the faced problems. In addition, in learning math teachers have to use strategies that can improve the ability of mathematical problem solving in students. So it must have a way to improve students' problem-solving abilities in learning mathematics. Mataka, Cobern, Grunert, Mutambuki, and Akom (2014)[6] said in a study to improve problem-solving abilities of students, teachers require effective teaching strategies. Teachers can use a variety of approaches, strategies, techniques or learning model. One type of learning that is recommended by using problem-based learning model. Usually called PBL. According to Arends (in Trianto 2011)[14] problem-based learning (PBL) is a model of learning in which students work on authentic problems with a view to construct their own knowledge, develop inquiry and thinking skills, develop independence and confidence. Cazzola (2008)[2] suggested that PBL is an instructional learning centered on empowering learners to do research, to integrate theory and practice and apply their knowledge and skills to develop a viable solution to a problem. This model is characterized by the use of real-life problems as something to be learned students to train and improve the skills to think critically and solve problems, and gain knowledge of key concepts. problem-based learning is an instructional model that begins with the problem. This is consistent with the proposed Bilgin, Senocak & Sozbilir (2008)[1] who found problem based learning (PBL) is an instructional model that can help students to think, solve problems, mengkonstruksikan important concepts to improve students' conceptual and quantity completion problem students.

Issues raised that require authentic investigation inquiry capabilities and high level thinking skills can be developed. New knowledge and experiences obtained by using prior knowledge and experience. Thus, the problem that there is used as a means for students to learn something that can support the science. The syntax of learning based on problems, such as: 1) orientation of students on the issue; 2) Organize students to learn; 3) To lead the investigation of individual / group; 4) Develop and present the results of the work; and 5) Analyze and evaluate the problem solving process. Trianto (2011) stated that the problem-based learning has advantages and disadvantages in the learning process. The advantages of problem-based learning model is as follows: (1) Realistic to student life; (2) The concept according to the needs of students; (3) Nurture nature of student inquiry; (4) Retention of concept is so strong; and (5) Cultivate the ability of Problem Solving. In addition to the advantages there are also disadvantages, among others: (1) Preparation of learning (tool, problem, concept) complex; (2) Difficulty in finding the relevant problems; (3) Often miss-conception; and (4) Requires considerable time in the investigation process.

The differences between PBL and conventional study are: In the conventional study: (1) Students only receive knowledge that given by the teacher (2) the truth about what knowledge is final and absolute. (3) The interaction of students is very less. While in PBL: (1) Students who are independent or autonomous, (2) Students who have high skills, (3) Students who want to work as individuals and groups, (3) Students who are able to communicate actively in learning, (4) students who are able to look at the problem of multi-dimensional and able to understand the deeper problem, (5) students who are able to think critically, creatively, higher level thinking skills and science. Therefore, increased problem-solving ability of students including important things to learn mathematics better and succeed. In other words, it can be said PBL learning model that can be done individually or in a social group. As said Chuan-Li

(2011)[3] that PBL is a learning approach that involves activity on problem-based situations and utilization of cognitive abilities, and they work as a group to give meaning to the knowledge in building a social learning process.

2. RESEARCH METHODS

This type of research that used in this research is conducted in a quasi experiment. This research is done by MTs Al-Yusriyah. This study was conducted in November 2015. Population in this study were all students of class VIII. While the selection of a sample is done by purposive sampling techniques. The sample in this study were two classes, VIII-A which is used as the experimental class and class VIII-B used as a control group. Which became independent variables in this study are: problem-based learning model, while the dependent variable of the study is the ability of students' mathematical problem solving. The study involved two classes are treated differently. In the experimental group were treated by applying problem-based learning model, while the control group was treated by applying conventional learning. The study involved the type of instrument, a test that is test material description on the Pythagoras Theorem.

Data were analyzed from this study were obtained through tests. To see the effect with an increased presence of mathematical problem solving ability of students, the experimental class and the control class were each given a pretest and posttest. Analysis of test data a mathematical problem solving ability of students in the form of descriptive analysis of data, normality test, homogeneity and hypothesis test.

3. RESEARCH RESULT

This study was conducted to determine whether there is an effect of problem based learning to students' mathematical problem solving ability. Based on the analysis of research data, the author can propose a few things, such as:

Table 1. Descriptive Statistic Pretest Score of Experimental Class and Control Class

No	Statistics Measurement	Test	
		Experimental Class	Control Class
1	The number of students	20	20
2	Total Score	800	815
3	The maximum score	60	60
4	The minimum score	25	25
5	Mean	40,00	40,75
6	Standard deviation	9,597	9,77

Based on table 1 above shows that, out of 20 students on average pretest experimental class and control class was 40.00 is 40.75. Based on the results of the average pretest score two classes, seen between the experimental class and control class the differences are not too far and is still relatively low. So the research will continue to implement the learning in two classes with the same materials and ingredients, just a different treatment. In the experimental group were treated by applying learning by problem-based learning model, while the control group was treated by applying conventional learning. Furthermore terminated by giving posttest to measure and obtain data on student's mathematical problem solving ability.

Table 2. Descriptive Statistic Posttest Score of Experimental Class and Control Class

No	Statistics Measurement	Test	
		Experimental Class	Control Class
1	The number of students	20	20
2	Total score	1538	1362
3	The maximum score	90	85
4	The minimum score	55	47
5	Mean	76,94	68,10
6	Standard Deviation	7,756	10,467

Based on the table 2 above, posttest results obtained in the experimental class with an average of 76.94 and an average grade of 68.10 controls showed that the experimental class that has been given learning using problem

based learning, math problem-solving abilities more high when compared with classroom problem-solving abilities in control by conventional learning.

Table 3. Average of Values pretest and posttest of Experimental Class and Control Class

Class	Pretest	Posttest	Different
Experimental	40,00	76,94	36,94
Control	40,75	68,10	27,35

Of the average value in the table above shows that the students' mathematical problem solving ability experimental class increased 36.94 after a given learning using problem-based learning model. While the control group increased by only 27.35

Table 4. Tests of Normality of Experimental Class and Control Class

Tests of Normality

Class	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pretest Experimental	.151	20	.200*	.944	20	.281
Control	.131	20	.200*	.954	20	.438

a. Lilliefors Significance Correction

*. This is a lower bound of the true significance.

Tests of Normality

Class	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Posttest Experimental	.176	20	.106	.912	20	.071
Control	.172	20	.123	.950	20	.370

a. Lilliefors Significance Correction

According to the table significance (Sig) Kolmogorov-Smirnov's = 0.05 to $n = 20$, the value of significance as follows:

The significance of the experimental class pretest score was 0.200 and the posttest is 0.106 and the significance of the control class of pretest value is 0.200 and posttest is 0.123. Then it can be concluded that the data pretest and posttest experimental class and control class is normally distributed data.

Table 5. Test of Homogeneity of Variances

Pretes

Levene Statistic	df1	df2	Sig.
.051	1	38	.822

According to the table 5 can be seen Levene Statistic value is 0.051 with a significance value > 0.05 is 0.822. So based on the criteria it can be concluded that all the samples have the same variance or homogeneity requirements are met.

Table 6. Test of Homogeneity of Variances

Postes

Levene Statistic	df1	df2	Sig.
2.564	1	38	.118

From Table 6, clearly visible Levene Statistic value is having a significant $2,564 > 0.05$ is 0.118. So based on testing criteria can be concluded that all the samples have the same variance or homogeneity requirements are met.

Table 7. 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
Kemampuan_ Pemecahan_ Masalah	2,564	.118	2.988	38	.005	8.650	2.894	2.791	14.509
			2.988	34.710	.005	8.650	2.894	2.772	14.528

According to the table above in the column of *T-test for Equality of Means* visible results thitung 2.988 and ttable with $df = n_1 + n_2 - 2 = 38$ amounted to 1.684. Decision-making by looking at the $t (2.988) > t$ table (1.684) means that H_0 is rejected and H_a is accepted. This means that there is effect of using of problem-based learning model to the students' mathematical problem solving ability.

4. DISCUSSION

The results of this study indicate that there are effects of problem based learning to students' mathematical problem solving ability. Problem based learning in the learning process requires students undertake an investigation authentic to real problems to find the solution of the problem. This is in line with Rangkuti (2014)[11] who conducted a study entitled upgrading conceptual understanding and problem solving mathematical vocational students through problem-based learning to get the result that an increase in the ability of understanding concept of students were given a problem-based learning is higher than the students who were given an usual lesson , As well as the increase derived mathematical problem solving ability of students were given a problem-based learning is higher than the students who were given regular learning.

In this research, problem-solving ability is measured by the ability of students to solve a problem by four stages, namely understand problems, plan solutions, implement the settlement plan and to re-examine the truth of the results obtained. By doing learning activities are designed according to the characteristics and stages of problem based learning model enabled the emergence of indicators of problem solving. This can be seen when students are working on Student Activity Sheet (LAS) and mathematical problem solving ability test serving contextual issues. During the learning activities take place, this problem based learning to encourage students in learning activities to help each other, sharing, respect between different learning abilities possessed by each student. The results showed that the model of problem-based learning can provide a boost to the students to learn to be affecting an increasing mathematical problem solving ability of students.

5. CONCLUSION

Based on the data analysis that has been presented and the discussion of the results of research that has been described, it can be concluded as follows:

There is an effect of using of problem-based learning model to the mathematical problem solving ability of students of MTs Al-Yusriyah this can be seen from the results of hypothesis testing, the results obtained H_0 rejected and H_a accepted. Decision-making can be seen from the $t (2.988) > t$ table (1.684). It can be seen that the average student mathematics problem solving ability experimental class is greater than the average value control class. This means that students who have been granted an experimental class teaching by using problem based learning, math problem-

solving ability is higher when compared to the students problem solving abilities in the control class by conventional learning. This means there is the effect of the use of problem-based learning model to the mathematical problem solving ability of students of MTs Al-Yusriyah.

6. SUGGESTION

Based on the research results and conclusions that have been described, in the latter part of the study put forward some suggestions as follows:

1. For School, willing to study and socialize this problem based learning on teachers and motivate teachers to implement it and make the problem based learning as an ingredient contribute ideas in order to improve mathematical problem solving ability of students in the school.
2. For the teacher, can be used as an alternative to learning to improve students' mathematical problem solving ability.
3. For researchers Furthermore, it can use the results, findings, or conclusions of this study as a reference in further research.

7. REFERENCE

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