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The Effect of Problem-Based Learing On Students' Mathematics Problem Solving Ability

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ABSTRACT

The purpose of this study was to determine the effect of problem-based learning on students' mathematics problem solving ability at SMA Negeri 1 Tanjung Palas Tengah. This research is an experimental research with pretest- posttest control group design. The population in this study were all grade XI students at SMA Negeri 1 Tanjung Palas Tengah. The sample was drawn using cluster random sampling technique and the research sample was obtained, namely class XI IPA 1 with a total of 15 students as an experimental class and class XI IPA 2 with a total of 15 students as a control class. The data collection technique in this study was a written test. Data analysis in this study used descriptive analysis, namely the average and standard deviation and prerequisite tests, namely normality test and homogeneity test for initial data and hypothesis testing using independent sample t-test statistical test. The results of the descriptive analysis showed that the average pretest score in the experimental class was greater than the average pretest score in the control class, which was 59.87 in the experimental class while in the control class it was 52.87. While the posttest value in the experimental class was 79.93, while in the control class it was 65.33. Based on the results of the independent sample t-test analysis with a significant level of 5% ($\alpha = 0.05$). Thus H_0 is rejected and H_1 is accepted, so it can be concluded that the problem-based learning model affects the problem solving ability of class XI students of SMA Negeri 1 Tanjung Palas Tengah.

Keywords: Problem Based Learning, Mathematics Problem Solving Ability

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1. Introduction

Education has a role in improving the quality of human beings as development resources and becomes the central point of development. The quality of a country's human resources is largely determined by the quality of education they provide to their citizens (Baum, 2015). Therefore, a country must be able to prepare and reform education continuously so that its citizens can participate fully in social life and can survive in today's global competition. Based on the function of national education, one must develop their abilities, it is necessary for students to develop them in the learning process. One of the educational subjects is mathematics (Jenrisen, 2020).

The National Council of Teachers of Mathematics (NCTM, 2020) stipulates that there are five standards for the mathematics learning process, namely problem solving, reasoning and proof, communication, connection and representation. Based on the five standard processes above, problem solving ability is one of the abilities in mathematics that is very important and must be developed in students during the mathematics learning process (Siagan *et al*, 2019). Problem solving is the ability of students to solve mathematical problems by paying attention to the process of finding based on the steps of solving problems, namely understanding the

problem, planning problem solving, solving the problem, and checking again. This is in accordance with what Polya said (Hendriana & Soemarmo, 2014; Simumora & Saragih, 2019). According to Hidayat & Sariningsih (2018), learning mathematics problem solving is the core of learning which is a basic ability in the learning process. To improve the ability to solve problems, it is necessary to develop skills to understand problems, make mathematical models, solve problems and interpret their solutions.

The reality in the field when researchers conducted a preliminary study at one of the schools, and from the results of the preliminary study the authors conducted interviews with mathematics subject teachers who taught in class XI IPA 1 at SMA Negeri 1 Tanjung Palas Tengah. Based on the notes given in class lessons, when given a problem that is slightly different in presentation from the example problems explained by the teacher, students are confused, while the problem has the same purpose and purpose, it is just made in a different format, for example students have been reminded many times to write down the known and questionable elements to make it easier to solve problem solving problems (Nuari & Assaibin, 2023). This indicates that students' problem solving skills are still lacking.

One of the learning that can be taken is by using group learning and learning that is often used in group learning is Problem Based Learning. One of the lessons that can be taken to overcome the lack of problem solving skills is to use a learning model that encourages students to participate actively, classroom activities cannot run smoothly if students do not participate actively. But often students become less active in learning because students only receive material from the teacher. Therefore, learning only takes place in one direction. With Problem Based Learning, this situation can be overcome because it makes students the focus of learning. Learning will also be more interactive because students are required to participate directly. By dividing students into groups, students will feel motivated to be more involved and talk about how to solve problems.

Researchers chose the Problem Based Learning model because this learning model is a contextual learning model using problems as the main focus of learning. The advantages of problem-based learning models include: 1.) encourage students to have the ability to solve problems in the real world; 2.) build student knowledge through learning activities; 3.) learn material that is in accordance with the problem; 4.) scientific activity occurs through group work for students; 5.) communication skills will be formed through discussion activities and achievement of work results, 6. through group work students who experience difficulties individually can be overcome (Shoimin, 2017).

There are four stages of problem solving which are detailed as follows: 1) Understand the problem; 2) Making a plan (devise a plan), where students need to identify the operations involved as well as the strategies needed to solve the given problem; 3) Carry out the plan (carry out the plan), if for example the plan cannot be implemented, then students can choose another method or plan; 4) Checking back (looking back), where the aspects that need to be considered are the following.

Based on the explanation above, it encourages the author to conduct research that focuses on a problem-based approach to determine its influence in efforts to improve students' Mathematics problem-solving abilities. For this reason, the researcher took the research title,

namely “The Effect Of Problem-Based Learing On Students’ Mathematics Problem Solving Ability”

2. Methods

The method used in this research is a quantitative approach because the type of data used is in the form of numbers. In a quantitative approach, the type of research used is experimental. The experimental research method is a research method that aims to test a theory or look for the effect of a variable on other variables with certain treatments on others in controlled or controlled conditions. Sugiyono (2018) states that the experimental method is a method used to seek the effect of certain treatments on others under controlled conditions. the design in this study was Pretest-posttest Control Group Design.

Table 1. Pretest-posttest Control Group Design

Category	*Pre-test*	Perlakuan	*Post-test*
Experiment Class	O_1	X	O_2
Control Class	O_3	-	O_4

The subject population in this study were all grade XI students at SMA Negeri 1 Tanjung Palas Tengah consisting of 2 classes, grade XI IPA 1 consisting of 15 students and grade XI IPA 2 consisting of 15 students totalling 30 students. The sample is part of the number and characteristics of the population (Sugiyono, 2018). Determination of the sample in this study using probalitiy sampling with Cluster Random Sampling technique. Cluster Random Sampling is an area used to determine the sample when the object to be studied or the data source is very broad.

The instrument used in this research is a test of mathematical problem solving skills in the form of descriptions. The material used in this test is Linear Programme material. Data analysis techniques in quantitative research use statistics. There are two types of statistics used for data analysis in research, namely descriptive statistics and inferential statistics (Sugiyono, 2018).

3. Result and Discussion

This research was conducted for 6 meetings. The first meeting, students were given a test of Mathematics problem solving ability (pre-test), Second Meeting, learning material about the basic concepts of linear programmes. In the third meeting, students learned the material about solving two-variable linear inequalities and two-variable linear inequality systems. In the fourth meeting, students learn material about the rules of linear programmes (Principles of linear programmes, Mathematical models and problems involving linear programmes. In the fifth meeting, students learnt about how to solve optimisation problems with crosshairs and with the corner point test. In the sixth meeting students were given a test of mathematics problem solving ability (post-test). The post-test aims to measure students' mathematical problem solving ability after being given learning by using problem-based learning.

Table 2. Descriptive Results of Students' Mathematics Problem Solving Ability Based on Classes

Class	Value	Number of Student	Minimal	Maximum	Average	Standard Deviation
Exsperiment	*Pre-Test*	15	45	78	59,87	8,008
	Post-Test	15	70	94	79,93	7,878
Kontrol	*Pre-Test*	15	35	65	52,87	7,396
	Post-Test	15	46	76	65,33	8,050

Based on table 2, the results of descriptive analysis using the help of SPSS 25.0 for Windows software show that the average value of students' Mathematics problem solving ability before treatment in the experimental class and control class, namely the experimental class of 57.87 and the control class of 52.87. As for the average value of students' Mathematics problem solving ability after treatment, the difference between the experimental class and the control class was seen, namely the experimental class of 79.93 and the control class of 65.33. It can be concluded that the average value of students' Mathematics problem solving ability of the experimental class is higher than the average interest in learning Mathematics of the control class.

The next analysis is Inferential analysis which consists of Normality Test and Homogeneity Test.

Table 3. Normality Test of Experimental Class Data (Pre-Test Post-Test) and Control (Pre-Test Post-Test)

Class	*Kolmogorov-Smirnov*			Test Decision	Conclusion
	Statistics	Df	Sig.		
Pret-Test Exsperimet (Eksperiment)	0,141	15	0,200	Accept H_0	Normal
Post-Test Exsperiment (Eksperiment)	0,201	15	0,105	Accept H_0	Normal
Pret-Test Control (Conventional)	0,214	15	0,064	Accept H_0	Normal
Post-Test Control (Conventional)	0,163	15	0,200	Accept H_0	Normal

Based on table 3, it can be seen that the significance value of the Pre-Test and Post-Test results of the experimental class given the treatment of the problem-based learning model Pre-Test and Post-Test of the control class given the treatment of the conventional learning model is $\geqslant$0.05 then H_0 is accepted. This indicates that both samples, namely the experimental class and the control class treated with the problem-based learning model and the control class treated with the conventional learning model, are normally distributed.

Table 4. Homogeneity Test of Experimental Class and Control Class

Ket.	*Lenence Stattistics*	df_1	df_2	Sig.	Decision
Before Treatment	246	1	28	624,	Homogeneous
After Treatment	0,00	1	28	984,	Homogeneous

Based on table 4 above, it is obtained that the homogeneity data of Mathematics problem solving ability before treatment is 624 and after treatment is 984. This value shows that the significant value is greater than 0.05, then Ho is accepted so it can be concluded that the data from the Mathematics problem solving ability test before and after treatment has a homogeneous variant.

The next analysis is the initial condition hypothesis test (pretest) and the final condition hypothesis test (posttest). Hypothesis testing was carried out to determine whether or not there was an effect of the problem-based learning model on the Mathematics problem solving ability of class XI students of SMA Negeri 1 Tanjung Palas Tengah.

Table 5. Hypothesis Test Results Initial Condition (pre-test)

Independent Sampel Test	t_{value}	Significance
Test Score Before Treatment	2,487	0,019

Based on table 5 above, a significant value of 0.019 was obtained. Output results of initial condition hypothesis testing using SPSS 25 for Windows software. This means that the significant value is less than 0.05 so that H_0 is accepted and H_1 is rejected . Therefore, the hypothesis that reads "There is any difference in the average students' mathematics problem solving ability between the experimental class taught using the problem-based learning model and the control class taught using the conventional learning model" can be accepted. This means that the mathematics problem solving ability of experimental and control class students has the same or equal initial condition before being given treatment in both classes. Thus, to further see whether or not there is an effect of using the problem-based learning model on the mathematics problem solving ability of class XI students of SMA Negeri 1 Tanjung Palas Tengah, there needs to be a further test, namely the average test using the mathematics problem solving ability test data after treatment.

Table 6. Hypothesis Test Results of Final Condition (pret-test)

Independent Sampel Test	t_{value}	Significance
Test Score Before Treatment	5,020	0,000

Based on table 6 above, the tcount value = 5.020 is obtained with a significant = 0.000. This means that the significant value is smaller than 0.05 so that H_0 is rejected and H_1 is accepted. Therefore, the hypothesis that reads "students' interest in learning Mathematics taught using problem-based learning model is greater or equal to students' Mathematics

problem solving ability taught using conventional learning model" can be accepted. This means that the students' Mathematics problem solving ability after being treated in the experimental class is greater or equal to the control class. Thus it can be concluded that there is a significant effect of using problem-based learning model on Mathematics problem solving ability of grade XI students of SMA Negeri 1 Tanjung Palas Tengah.

This is indicated by the significance value < 0.05, namely 0.000 < 0.05. Thus H_0 is rejected and H_1 is accepted. Therefore, the hypothesis that reads "the Mathematics problem solving ability of students taught using problem-based learning model is greater or equal to the Mathematics problem solving ability of students taught using conventional learning model." is accepted.

4. Conclusion

Based on the results of the t-test calculation managed using SPSS 25.0, a significance value of 0.000 was obtained with a significant level of 5% (α 0.05), so the significance value <0.05. So it can be concluded that the problem-based learning model has an effect on the ability to solve mathematics problems of class XI SMA Negeri 1 Tanjung Palas Tengah, or in other words that H_o is rejected and H_1 is accepted. Thus, the average Maths problem solving ability of students taught using problem-based learning model is greater than the Maths problem solving ability of students taught using conventional learning model can be accepted.

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