

The Effect of Using The Problem-Based Learning Model on Learning Outcomes of Class VIII Students Junior High School

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Abstract: This research aims to determine the effect of the problem-based learning model on the learning outcomes of class VIII students at SMP IT YARSI Mataram on relationship and function material. The method used is a quasi-experimental method, with a posttest-only group design research design. The sample use in this research is saturated because all members of the population were sampled. The sample used in this research was all 39 students in class VIII of SMP IT YARSI Mataram. The instruments in this research are test question, learning implementation plans, and learning activity observation sheets. Data collection was carried out using test instruments. The research results were tested for normality with the Liliefors test and homogeneity test with Fisher's test, then analyzed using the t-test. The result of the t-test analysis show $t_{count} = 1,920$, $t_{table} = 1,687$ with a significance level of $\alpha = 0,05$. This shows that the problem-based learning model affects the mathematics learning outcomes of class VIII students at SMP IT YARSI Mataram. Therefore, the problem-based learning model should be used in learning to improve students' mathematics learning outcomes.

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Introduction

Mathematics is the result of human abstraction of objects around them and can solve problems that occur in life. With mathematics, we can practice thinking logically, and with mathematics and other sciences, we can develop quickly (Susilawati, 2015). Apart from that, mathematics is a science that enables humans to think logically and confidently, apart from being a tool for solving real-world problems that can be simplified using mathematical models (Baidowi, Hikmah, & Amrullah, 2019). There are still many students who position mathematics as the same as other subjects which refer more to memorization (Muhayana, Sridana, Prayitno, & Amrullah, 2021). This is accordance with the opinion of Zulva, Turmuzi, and Saputra (2022) who stated that currently mathematics is still considered a difficult subject by students.

One of the important things in mathematics learning is students' mathematics learning outcomes. Learning outcomes are changes in students, both regarding cognitive, affective, and aspects psychomotor. With learning outcomes, the extent to which students understand the subject matter can be known (Rahmatullah, Sripatmi, Kurniawan, & Hayati, 2022). A teacher

must be able to teach learning material and be able to explain learning topics so that maximum learning outcomes are achieved (Sembiring & Situmorang, 2015). Mathematics learning outcomes can be used to determine students' level of success in understanding mathematics lessons expressed in grades in the form of letters or numbers (Hiqwan, Amrulloh, Salsabila, & Soeprianto, 2023).

Based on the results of observations of mathematics learning activities at SMP IT YARSI Mataram on Friday, December 2, 2022, it is known that mathematics subject teachers at the school use the STAD (Student Team Achievement Division) cooperative learning model. With this STAD-type cooperative learning model, students will be grouped into several groups which are divided heterogeneously. From them results of these observations, it can be seen that the implementation of the cooperative learning model by the teacher is not optimal, this can be seen from the uneven distribution of tasks in each group. So students with high mathematical abilities dominate in completing the group assignments given, while students with moderate and low mathematical abilities become less active in learning activities, and this causes students with medium and low mathematical abilities to have difficulty understanding the material being discussed.

Apart from that, based on the results of interviews with mathematics subject teachers, it is known that some students are not interested in mathematics lessons. During group discussions, only a few group members work. There are still many students who are lazy about asking, answering, or responding to questions from teachers and other students, causing students to be less active in learning activities and these students have difficulty solving mathematical problems. Therefore, there are still many students whose mathematics learning results are below the KKM (Minimum Completeness Criteria).

Based on data on mid-event exam scores for class VII students for the 2022/2023 academic year, the majority of students have not yet reached the KKM. Where the KKM applied by the school is 75. And the classical completeness applied by the school is 75%. Based on score data from two classes, namely class VII Ibnu Sina and class VII Al Khawarizmi, it was obtained that the Ibnu Sina class, which consisted of 19 students, the average score of 69.1. As for the Al Khawarizmi class, which consists of 20 female students, the average score is 70. The percentage of classical completion for class VII Ibnu Sina and class VII Al Khawarizmi shows that there are still many students whose scores have not reached the KKM.

Based on the description above, it can be seen that the percentage of classical completeness is far from the set standards. This means that most students have not mastered the mathematics subject matter before the mid-term exam. This can happen because students do not listen or pay attention to the teacher's explanation during mathematics learning. So teachers need to try other innovations in mathematics learning, one of which is by using a learning model that is different from the learning model usually used. One of them is by implementing a student-centered learning model. One model of student-centered learning that teachers can use to improve student learning outcomes is the problem-based learning (PBL) model.

Problem-based learning is a learning model that involves students trying to solve problems in several stages so that students can learn knowledge related to the problem and students are expected to have skills in solving problems (Syamsidah & Suryani, 2018). According to Sani (2014), the syntax of the problem-based learning model in learning is (1) Orienting students to the problem; (2) Organizing students to study; (3) Guiding individual and group investigations; (4) Developing and presenting work result; and (5) Analyze and evaluate the problem-solving process.

There are several advantages of the problem-based learning model according to Sidiq, Najuah, and Lukitoyo (2021) which can improve students' mathematics learning outcomes, namely, (1) Discussions between groups can foster a sense of solidarity between friends; (2) Students will be used to facing problems and feel challenged to solve problems both in class and outside of class (everyday life); and (3) Individual students' learning difficulties can be overcome by group study.

One of the materials in class VIII odd semester is relations and functions. Relations and function are usually used to solve problems in everyday life. This material is by the problem-based learning model. Whereas the problem-based learning model uses real-world problems that must be solved by students.

Several previous studies that have been conducted show that the problem-based learning model can improve student learning outcomes. Yasa and Bhoke (2018) conducted research on fraction material in fifth-grade elementary school. Research shows that the problem-based learning model influences students' mathematics learning outcomes. Apart from that, Darlin and Fathonah (2021) also conducted similar research. This research was conducted on relations and functions material for class VIII SMP.

Based on the description above, researchers are interested in conducting research with the title "The Effect of Using the Problem-Based Learning Model on the Learning Outcomes of Class VIII Students at SMP IT YARSI Mataram on the Material of Relations and Functions for the 2023/2024 Academic Year".

Research Method

The type of research used is quantitative with quasi-experimental methods (Quasi-experimental). This research design uses Posttest-Only Group Design. The population that will be used in this research is all class VIII students at SMP IT YARSI Mataram, totaling 39 students, where these students are divided into two classes. Where there are 19 male students and 20 female students. The sample used is saturated because all members of the population are sampled. The samples used in this research were students of class VIII Al Khawarizmi (experimental class) and class VIII Ibnu Sina (control class). Data collection in this research used the test method. This research uses two types of instrument is the Learning Implementation Plan (RPP). Meanwhile, the data collection instruments are test questions and observation sheets for the implementation of learning by teachers and students.

However, before conducting research, a validity test must first be carried out. The validation of the instrument in this research was proven using content validation. The content validation in research is determined by expert assessment. To determine the level of validity of an instrument, the score obtained based on the validator's assessment will be calculated using the Aiken index formula, which is as follows:

$$V = \frac{\sum S}{N(C - 1)}$$

Table 1 Instrument Validity Criteria

No.	Average Score	Validity level
1	$0,8 < V \leq 1,0$	Very valid
2	$0,4 < V \leq 0,8$	Enough valid
3	$0 < V \leq 0,4$	Not enough valid

Source: Damayanti, Suana, and Riyanda (2022)

In addition, prerequisite tests are carried out before hypothesis testing is carried out. The prerequisite test consists of:

1. Normality test

The normality test is carried out to determine whether the distribution of the sample data studies comes from a normally distributed population or not. The normality test used was the Liliefors test. If $L_{count} < L_{table}$ then the sample has a normal distribution.

2. Homogeneity test

The homogeneity test is used to show that the posttest score for the experimental class and control class come from a population that homogeneous variance or comes from a population that has a small level of diversity. The homogeneity test in thi study used the Fisher test, whit the formula:

$$F_{count} = \frac{\text{Largest variance}}{\text{Smallest variance}}$$

After carrying out the prerequisite test, proceed eith hypothesis testing. The hypothesis test used is the t-test.

3. T-test

The t-test functions to test how the independent variable influinces the dependent vriable. The t-test aims to determine the difference in mathematics outcomes of class VIII SMP students on relations and function material using the problem-based learning model and the learning outcomes of students using the cooperative learning model. The t-test formula used is:

$$t_{count} = \frac{\bar{x}_1 - \bar{x}_2}{s \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$$

Result and Discussion

Result

Research activities were carried out in four meetings. Three meetings were filled whit learning activities, and one meeting held a posttest. The details of research activities can be seen in the following table:

Table 2 Research Activities

Date	Activity	
	Experimental class	Control class
24 August 2023	Meeting 1 relationship material	Meeting 1 relationship material
31 August 2023	Meeting 2 function material	Meeting 2 function material
7 September 2023	Meeting 3 one-on-one correspondence material	Meeting 3 one-on-one correspondence material
14 September 2023	Posted material on relations and functions	Posted material on relations and functions

The validators in this research consisted of 2 validators, namely a mathematics education lecturer and a mathematics teacher at SMP IT YARSI Mataram. The assessment results from both validators show that the learning instrumen, namely lesson plans, observation sheets of learning activities, and test instruments are valid for use.

Based on test result data after learning activities in each class, the following results were obtained:

Table 3 Data on Mathematics Learning Outcomes

Class	Value Range	Frequency	Measure of Central Tendency			Ukuran of Group Variance	
			\bar{X}	<i>Me</i>	<i>Mo</i>	<i>R</i>	<i>S</i>
Experiment	70–74	5	85,4	86	86	28	9,49
	75–79	0					
	80–84	3					
	85–89	5					
	90–94	3					
	95–99	4					
Control	68–73	5	79,68	76	76	30	9,07
	74–79	6					
	80–85	4					
	86–91	1					
	92–97	2					
	98–103	1					

Data analysis

1. Normality Test

Student mathematics learning outcomes in this study used the Liliefors test.

Table 4 Class Normality Test Results Experiment and Control

Treatment	L_{count}	L_{table}	Test Decision
Experiment	0,135	0,190	H_0 accepted
Control	0,183	0,195	H_0 accepted

Based on the table above, it can be seen that $L_{hitung} < L_{tabel}$, so H_0 accepted. Thus the data comes from a population with normal distribution

2. Homogeneity Test

The homogeneity test in this study used the Fisher test. The calculation results can be seen in the following table:

Table 5 Class Homogeneity Test Results Experiment and Control

Group	F_{count}	F_{table}	Test Decision
Experiment & Control	1,094	2,203	H_0 accepted

The test results have a significance level of $\alpha = 0,05$. This, $F_{count} \leq F_{table}$, so that H_0 is accepted, meaning the data comes from a homogeneous population.

3. Hypothesis Testing

Hypothesis test results can be seen in the following table:

Table 6 Hypothesis Test Results for Experiment and Control Classes

Group	t_{count}	t_{table}	Test Decision
Experiment & Control	1,920	1,687	H_0 Rejected

Obtained $t_{count} > t_{table}$ means H_0 is rejected, so it can be concluded that there are differences in mathematics learning outcomes between students who use problem-based learning models and students who use cooperative learning models.

Discussion

Based on the observation sheet on the implementation of learning by the teacher and students, in the experimental class the learning activities carried out by teachers and students are by the syntax of the problem-based learning model, namely: 1) Orienting students towards problems; 2) Organizing students to study; 3) Guiding individual and group investigations; 4) Develop and present work result; 5) Analyze and evaluate the problem solving process. The observation sheet according to the observer indicators of preliminary activities all descriptors have been implemented by the teacher. However, in the closing activity indicator there are descriptors that are not implemented by teacher, namely the teacher does not inform the next meeting's subject matter and does not pray before ending the lesson. This was because the math lesson time was over so teacher did not have time to do it.

As for the control class, based on the observation sheet the implementation of learning by teachers and students is carried out by the steps of the cooperative learning model, namely: 1) Conveying learning objectives and motivating students; 2) Presenting information; 3) Organize students in groups; 4) Guiding work and study group; 5) Evaluation of learning outcomes; 6) Give awards. The observation sheet according to the observer indicators of core activities all descriptors have been implemented by the teacher. However, in the indicators of preliminary activities and closing activities there are descriptors that are not implemented by the teacher, namely the teacher does not ask how the students are doing and does not pray before ending the lesson. This is because the teacher forgot to ask how the students were doing and the math lesson time was over so the teacher did not have time to pray before ending the lesson.

After the experimental class applied the problem-based learning model and the control class applied the cooperative learning model, a posttest was carried out. The calculation results show that student learning outcomes in mathematics lessons on relations and functions using the problem-based learning model are higher than student learning outcomes in mathematics lessons on relations and functions using the STAD-type cooperative learning model. This is by calculations using the t-test. From these calculations, $t_{count} = 1,920$ and $t_{table} = 1,687$, so $t_{count} > t_{table}$ which means H_0 is rejected, so it can be concluded that there are differences in mathematics learning outcomes between students who use problem-based learning models and students who use cooperative learning models. This can be seen from the learning outcomes of the experiment class higher than the control class, where the experiment class average is 85,4 and the control class average is 79,68. In addition, from the score of the two classes, the percentage of classical completeness of the experimental class was 75% and the control class was 68%. So it can be concluded there is an effect of the problem-based learning model on mathematics learning outcomes for class VIII students of SMP IT YARSI Mataram.

The results of research that has been carried out show that there is an influence of using the problem-based learning model by solving real-world problems as the main problem on students' mathematics learning outcomes. The results of this research are in line with research conducted by Suhuda and Ahmad (2020) which states that there is a positive influence on the mathematics learning outcomes of students who use the problem-based learning model. Using the problem-based learning model provides many benefits, including active students, improving thinking skills and being able to solve problems presented by the teacher.

Apart from that, this research is also in line with research conducted by Robiyanti (2021) which states that the problem-based learning model can improve student learning outcomes. According to Robiyanto, the problem-based model can improve learning

outcomes because when students are faced with a problem, it will make students interested in solving the problem.

Apart from that, it is also the advantages of the problem-based learning model according to Amaliya, Fatimah, and Abustang (2019), namely: (1) Students are encouraged to have real-world problem-solving abilities; 2) Students build their knowledge through learning activities; 3) Scientific activities occur through group work; 4) Students can assess their learning progress; 5) Individual student learning difficulties can be overcome through group work. Thus, based on the description above, it shows that the problem-based learning model influences the learning outcomes of class VIII students at SMP IT YARSI Mataram.

Conclusion

Based on the results of the research and discussion, it can be concluded that there is an influence of the problem-based learning model on mathematics learning outcomes for class VIII students of SMP IT YARSI Mataram for the 2023/2024 academic year. This can be seen from the learning outcomes of the experiment class higher than the control class, where the experiment class average is 85,4 and the control class average is 79,68. In addition, from the score of the two classes, the percentage of classical completeness of the experimental class was 75% and the control class was 68%. And the t-test result obtained $t_{count} = 1,920$ and $t_{table} = 1,687$, so $t_{count} > t_{table}$.

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