OPEN ACCESS
Indonesian Journal of Pedagogy and Teacher Education Vol 2 No 1 (2024) https://doi.org/10.58723/ijopate.v2i1.127
Check for updates
Research Article

The Effect of Problem Based Learning Model on Mathematics Learning Outcomes of Class VIII Students at SMP Negeri 10 Bengkulu City

Received : December 28, 2023	Revised : March 30, 2024	Accepted: April 12, 2024	Publish : April 30, 2024

Aina Novita Irka*

Abstract:
Learning outcomes was the accomplishments of educational purpose for students who take part in the teaching and process of learning, student outcomes of learning are fundamentally behavioral changes brought about by learning. According to the findings, it was discovered that the outcomes of learning in mathematics of Class VIII students of SMPN 10 Kota Bengkulu for the 2022/2023 academic year were still low. So that the effort that can be made to increase student outcomes of learning in mathematics is to apply problem based learning learning models. This research purpose to see whether the the outcomes of learning in mathematics of students who study using the problem-based learning model in class VIII SMP Negeri 10 Kota Bengkulu was more good than the outcomes of learning by students using learning in conventional models.This research type was a quasi-experimental design with a non-equivalent posttest only control group design. The selection for sample was conducted using technique by simple random sampling, so that class VIIID was selected as the class for experimental and class VIIC as the class for control. The instruments in research were in consist of quizzes and final tests outcomes of learning in the form of essays. According on the research data analysis results at the real level $\alpha = 0.05$ using the t test obtained P-value = 0.018, that means that P-value < α so reject H0. This shows that the outcomes of learning by students in mathematics who study using the model of problem-based learning are more good than students who study using learning in models of conventional in class VIII SMPN 10 Kota Bengkulu.
Keywords: Effect, Mathematics Learning Outcome, Problem Based Learning

1. INTRODUCTION

Education is important in making a country developed (Alam, 2022). Relevant education must be based on the four pillars of education, which include: learning to know (learning about knowledge), learning to do (learning to use knowledge in skill development), learning to be (learning to change or develop through knowledge and skills, learning to live together (learning to create a shared living environment which is important to be aware of the interconnectedness of education and mutual respect for fellow human beings) (Masriah et al., 2023).

Education is a form of long-term investment in the future sustainability of the development of intellectual skills of learners (Dayagbil et al., 2021). Through this understanding, the learning process carried out at school can be pursued as the development of the ability to think from students (Parinussa et al., 2023). The ability to think is sought so that the learning process is achieved through not just doing the work (learning to do) which is the most important thing. However, it also has benefits in daily life (learning to live together) (Oktaviana et al., 2023).

Sima et al. (2020) provides a statement where learning is a stage or effort carried out by all individuals in achieving better behavior, both in the form of knowledge, skills, attitudes and good values into an experience through all the material that has been given in the learning process.

Mathematics is one of the disciplines that can support the improvement of the ability to think and provide arguments, contribute to the solution of daily problems and in the work environment, and also provide support for the development of science and technology (Khalid et al., 2020). Among the subjects with significant practical applications is mathematics. One of the objectives of learning mathematics is for students to value and use the subject in their daily life; that is, to have a strong sense of curiosity, focus, and interest in the subject matter, as well as persistence and self-assurance while tackling challenges (Szabo et al., 2020).

According to Liu et al. (2023) expressing the expression that one of the fields of study that must be given attention is the field of mathematics study, then educators who are facilitators must be able to create conducive teaching conditions. Because mathematics is included in the dominant field of study that is not favored by students. For them, the field of study has a tendency to become a field of study that is "scary" and "if possible can be avoided" because it is difficult. Considering the role of mathematics is so great, students are given demands to achieve an understanding of mathematics thoroughly at all units and levels of education. However, in fact, there are still a large number of students whose mathematics learning outcomes do not achieve the desired results.

Learning outcomes are included in the learning stages, students who are active actors in teaching and educators become active actors in the learning process (Winstone & Boud, 2022). Thus it can be concluded that learning outcomes are two parts that are viewed through two sides. When viewed through the direction of the learner the results of the learning process, but through the direction of the educator the learning outcome is when the completion of the teaching material.

Observations made at the beginning of the implementation of the Teacher Field Practice (PLK) at SMPN 10 Bengkulu City classes VII A-VII E totaling 140 people. The facts found from the learning outcomes of mathematics students reviewed through the UAS scores of class VII at SMPN 10 Bengkulu City are data where there is still a large field of mathematics study that has not reached the KKM standard set by the school, namely 70, which we can state where the learning outcomes of students are still very minimal, due to the greater percentage of students who still have not completed KKM compared to those who will complete KKM.

In line with this, in addition to the problem of learning outcomes from mathematics in students, there are also other problems during classroom observations, namely the activeness of students in the classroom is very low. The process of learning mathematics has been presented to students using the lecture method only, meaning that students just grab information from educators and have an impact on the lack of student interest in the learning process. Causing the concepts conveyed not to stick sharply to the memory of students which makes students forget easily and often feel confused when solving problems that are not the same as those that educators have given examples.

Problem Based Learning (PBL) is one of the learning models that is thought to be appropriate for enhancing students' learning outcomes in mathematics. PBL is thought to be able to support the increase in students' learning outcomes because of its features, which include the presentation of problems with real-world context, active group learners, problem formulation and identification of knowledge gaps, learning, and independent searches for material relevant to problems and solutions (Abdurahman et al., 2023).

Therefore, referring to the background above, this research is entitled "The Effect of Problem Based Learning Model Application on Mathematics Learning Outcomes of Class VIII Students at SMP Negeri 10 Bengkulu City".

2. MATERIAL AND METHOD

The type of research used is a pseudo-experiment (Maciejewski, 2020). This study aims to test the hypothesis of whether learning outcomes in mathematics using a problem-based learning model are superior to conventional learning processes. The research design used is a non-equivalent posttest-only control group design (Bulus, 2021).

The population of this study were students in grade VIII of SMP Negeri 10 Bengkulu City in the 2022/2023 academic year. The samples used were class VIIID which was designated as the group for the experiment and VIII C which was designated as the control group based on simple random sampling. The experimental group was given action, namely the application of the problem-based learning model, but the control group was not given action. At the final meeting, both sample classes were given a final test in the form of a quiz.

The variables for this study are independent variables and dependent variables (Pratama et al., 2022). The independent variable is the learning process that uses the problem-based learning model, and the dependent variable is math learning outcomes. The types of data used in this study are primary and secondary data Kosim et al. (2023), where the primary data is the results of the final test of learning outcomes held in the group for the experimental and control groups.

The research instrument is in the form of a math learning outcomes test. The test of mathematics learning outcomes was used to obtain quantitative data, namely the final score of mathematics learning outcomes. This test is in the form of an essay which includes 5 questions. The test results of mathematics learning outcomes were analyzed through the t-test

process. The research was conducted at SMP Negeri 10 Bengkulu City starting on November 4 - November 30, 2022.

This research procedure is divided into three stages:

1. Prepatory Stage

a. Determine the teaching material that will be used in the research, namely the straight line equation.
b. Determining the research site and research schedule. The research was conducted at SMP Negeri 10 Bengkulu City November 4 - November 30, 2022.
c. Arrange for a research permit.
d. Prepare learning tools consisting of Learning Implementation Plans (RPP) and LKPD as guidelines in the teaching process.
e. Arranging instruments in the form of quizzes, grids of learning outcome test questions, learning outcome test questions, and answer keys to learning outcome test questions, grids of learning outcome final test questions, learning outcome final test questions, and answer keys to learning outcome final test questions.
f. Conduct validation to the validator.
g. Requesting data on the final assessment value of odd semester mathematics class VIII SMPN 10 Bengkulu City.
h. Determining the research sample class after normality test, homogeneity test, and mean similarity test. The research sample class consisted of an experimental class and a control class. The sample class selected as the experimental class was class VIIID and the control class was class VIIIC.
i. Conducting test questions at other schools that have the same characteristics as the sample class.

2. Implementation Stage

The learning carried out in the experimental class used a scientific approach.

3. Completion Stage

The things done at the research completion stage are as follows:

a. Giving a test of student learning outcomes in the control class and experimental class to see the difference in students' math learning outcomes in the two classes in learning.
b. Processing data from the results obtained from the sample
c. Draw conclusions from the results obtained in accordance with the analysis used.

3. RESULT AND DISCUSSION

a. Math Learning Outcomes Quiz

After analyzing the data using Microsoft Excel, the following results were obtained:

Table 1. Average Quiz Score

Quiz to	Average	Category
1	58	Good
2	63	Good
3	73	Very Good
4	77	Very Good
Average	**68**	**Good**

Looking through table 1, we can see where the average quiz of mathematics learning outcomes of students in the experimental group who learn using the Problem Based Learning learning process model is 68 which is included in the interval 50 to 76 in good criteria which can be concluded where the mathematics learning outcomes of students who learn through the Problem Based Learning learning process produce good results. The average quiz scores and the percentage of completeness of students' scores at all meetings showed an increase. This was influenced by a number of factors, including students who quickly adapted to the learning process and most students were able to evaluate their mistakes when carrying out the learning process through asking questions and discussions with their groups. As well as getting support for the learning process that applies the problem-based learning model. In each quiz implementation, it can be seen that the ability of students when solving mathematical problems can be seen as a development. In the first quiz included by 28 students in the group for the experiment. The material presented is about the graph of a straight line equation.

In quiz 1, the percentage that was completed was 18%, 5 students who achieved scores above the KKM, namely 70. This is because in the first quiz students felt a number of difficult feelings, this is because students have not been accustomed to the learning process using the problem-based learning learning process. Participants are a little shy to express opinions and ask the educator if there are some difficulties when doing the LKPD work. So that

educators must make more effort to guide students. In addition, at the first meeting students were invited to reason to relate the images presented to the understanding that had been learned at the beginning of the learning process. In this case, students are still binging to reason and associate the images provided by the educator so that they must be guided by the educator. The class average obtained in quiz 1 is 58, so the average quiz 1 score is in the Good category.

Quiz II was participated by 28 students in the experimental group. The material tested was determining the slope of a straight line passing through the center point, and a special point. The percentage of completers in quiz II is 32% or 9 learners who have been able to achieve the maximum score on the question. There was an increase in the percentage of completeness in quiz II with an achieved class average of 63. Based on the class average qualifications that have been set, quiz II is classified in the good category. For this second meeting, we can see that students have begun to be confident and can give expressions of opinion and the difficult things that students feel have begun to decrease. Where it can be seen that some learners began to dare to ask questions and express opinions even though there were still very few who responded and students gradually began to adapt to the problem-based learning model.

Quiz III was participated by 29 students in the experimental group. The material tested is the equation of two lines that are parallel and perpendicular to each other. The percentage of students who completed quiz III was at 55% or 16 students who could achieve the maximum score on the questions presented. There is an increase in the percentage of completeness in quiz III, through the class average achieved in quiz III, namely 73. Based on the class average qualification, the average quiz III is included in the very good group. At the third meeting, students began to make the usual formulation of reasoning and linking the problems presented to the understanding they had learned at the previous meeting, although they still needed the guidance of the educator.

Quiz IV was participated by 29 students in the experimental group. The material tested was the equation of a line with a slope and through a certain point and the equation of a line through 2 points. The percentage of students who are complete in quiz IV is at 79% or which indicates that 23 students have been able to achieve the maximum score. It can be concluded that there is an increase in the percentage of completeness in the fourth quiz, with the class average obtained in quiz IV being 77. Through the class average qualifications that have been set, quiz IV is in a very good group. At this fourth meeting, students are used to the application of the problem-based learning model where students can draw conclusions about the learning process through the results of their discussion. Although there are still a number of learners who need guidance in determining conclusions, but some are able to make their own conclusions. So, through the average value of the completeness of the four quizzes that have been carried out, an overall conclusion can be drawn where the percentage of completeness of students' quiz scores has increased significantly from the first quiz to the fourth quiz.

b. Learning Outcome Test

The test for learning outcomes presented in the sample group is in the form of an essay with many 5 questions. The questions presented are achieved through a number of indicators from the straight line equation material. The learning outcomes test data was analyzed to achieve a description of the math learning outcomes data. The results of the description of the sample math learning outcomes data can be seen in the following table

Table 2. Mathematics Learning Outcomes In The Experimental and Control Groups

Class	N	$\bar{x}$	S	Xmaks	Xmin	Above 70
Experiment	29	79.93	9.83	95	58	23
Control	28	72.64	12.32	92	50	15

In Table 2. It is shown where the average score of the mathematics learning outcomes test of students in the experimental group is superior to the average of the control class learning outcomes test. The average score in the experimental group was 79.93 but the average of the control class was 72.64. In addition, the percentage of completeness of students in the group for experiments is superior to the control group. This also provides evidence that through the application of the Problem Based Learning learning process and also the group learning process can bring out the spirit of cooperation between fellow students.

Based on the results of data analysis, it can be noted the average score of students' abilities when

providing answers to learning outcomes questions as follows:

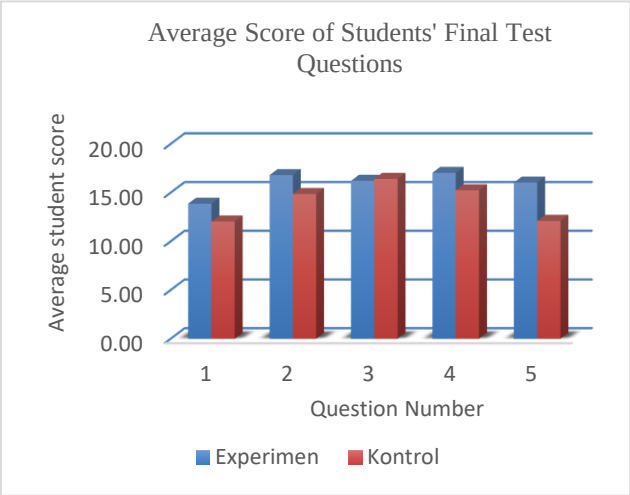

Figure 1. Average Score of Students' Final Test Questions

In the graph above, you can see the different results of the scores achieved by students when giving answers to the final test questions submitted by educators. The following is the explanation:

a. Problem number 1 the highest average score is 15. The average achieved in the experimental group is 13.86 but in the control group it is 12.03.
b. Problem number 2 the highest average score was 20. The average achieved in the experimental group was 16, but in the control group it was 14.86.
c. Problem number 3 the highest average score was 20. The average achieved in the experimental group was 16.21 but in the control group 16.41.
d. Problem number 4 the highest average score was 20. The average achieved in the experimental group was 17.03 but in the control group it was 15.24.
e. Problem number 5 had the highest average score of 25. The average achieved in the experimental group was 16.03 but in the control group it was 12.10.

From the description above, it is known that in questions number 1, 2, 4, and 5 the results achieved by the average score in the experimental group are superior to the control group. However, in question number 3 the results achieved by the average score of the control class were slightly superior to the experimental group. In general, it can be concluded that the ability of students in the experimental group is superior to the control group. This is due to the treatment presented by educators through a problem-based learning model that encourages students to be more active in thinking. Through this explanation, it can be concluded that the use of a problem-based learning model in the learning process of mathematics in class VIII at SMP Negeri 10 Bengkulu City can have an influence on the learning outcomes of students which has an impact on increasing the learning outcomes of students.

4. CONCLUSION

The mathematics learning outcomes of students in class VIII SMP Negeri 10 Bengkulu City who use the problem-based learning model are superior to the mathematics learning outcomes of students through the conventional learning process. This can be seen through the quiz value data that has been done at each meeting and the final test of learning outcomes. So that the learning outcomes of students whose learning stages use a problem-based learning model have increased.

AUTHOR INFORMATION

Authors

Aina Novita Irka, FMIPA, Universitas Negeri Padang, Indonesia
https://orcid.org/0009-0005-2963-9689
Email: ainanovitairka@gmail.com

REFFERENCE

Abdurahman, A., Asfahani, A., Sudarwati, N., Warwer, F., & Asrijal, A. (2023). The influence of problem-based learning model on students' learning outcomes. *International Journal of Trends in Mathematics Education Research*, *6*(3), 247–255. https://doi.org/10.33122/ijtmer.v6i3.226

Alam, A. (2022). Investigating Sustainable Education and Positive Psychology Interventions in Schools Towards Achievement of Sustainable

Happiness and Wellbeing for 21 st Century Pedagogy and Curriculum. *ECS Transactions*, *107*(1), 19481 – 19494. https://doi.org/10.1149/10701.19481ecst

Bulus, M. (2021). Sample Size Determination and Optimal Design of Randomized/Non-equivalent Pretest-posttest Control-group Designs. *Adıyaman Üniversitesi Eğitim Bilimleri Dergisi*, *11*(1), 48 – 69. https://doi.org/10.17984/adyuebd.941434

Dayagbil, F. T., Palompon, D. R., Garcia, L. L., & Olvido, M. M. J. (2021). Teaching and Learning Continuity Amid and Beyond the Pandemic. *Frontiers in Education*, *6*. https://doi.org/10.3389/feduc.2021.678692

Khalid, M., Saad, S., Abdul Hamid, S. R., Ridhuan Abdullah, M., Ibrahim, H., & Shahrill, M. (2020). Enhancing Creativity And Problem Solving Skills Through Creative Problem Solving In Teaching Mathematics. *Creativity Studies*, *13*(2), 270–291. https://doi.org/10.3846/cs.2020.11027

Kosim, M., Muqoddam, F., Mubarok, F., & Laila, N. Q. (2023). The dynamics of Islamic education policies in Indonesia. *Cogent Education*, *10*(1). https://doi.org/10.1080/2331186X.2023.2172930

Liu, Y., Han, T., Ma, S., Zhang, J., Yang, Y., Tian, J., He, H., Li, A., He, M., Liu, Z., Wu, Z., Zhao, L., Zhu, D., Li, X., Qiang, N., Shen, D., Liu, T., & Ge, B. (2023). Summary of ChatGPT-Related research and perspective towards the future of large language models. *Meta-Radiology*, *1*(2), 100017. https://doi.org/10.1016/j.metrad.2023.100017

Maciejewski, M. L. (2020). Quasi-experimental design. *Biostatistics & Epidemiology*, *4*(1), 38–47. https://doi.org/10.1080/24709360.2018.1477468

Masriah, Utaminingsih, S., & Utomo, S. (2023). The influence of problem based learning model on mathematics learning outcomes in elementary school students. *In AIP Conference Proceedings*, 030021. https://doi.org/10.1063/5.0140515

Oktaviana, V. D., Zulaihati, S., & Sumiati, A. (2023). Pengaruh Kebiasaan Belajar Terhadap Hasil Belajar Mata Pelajaran Administrasi Pajak Kelas XI Melalui Motivasi Belajar Siswa SMK Negeri Jakarta Timur. *Jurnal Riset Pendidikan Dan Pengajaran*, *2*(1), 84–103. https://doi.org/10.55047/jrpp.v2i1.448

Parinussa, J. D., Taryana, T., Ningtyas, A. A., Rachman, R. S., & Tannady, H. (2023). Developing Student Emotional Intelligence by Involving the Active Role of Teacher. *Journal on Education*, *5*(3), 8528–8533. https://doi.org/10.31004/joe.v5i3.1638

Pratama, S., Putra, A., & Basri, H. (2022). Independent and Dependent Variable: Influence on Jambi Province Rubber Exports. *Jurnal Prajaiswara*, *3*(2), 116–125. https://doi.org/10.55351/prajaiswara.v3i2.50

Sima, V., Gheorghe, I. G., Subić, J., & Nancu, D. (2020). Influences of the Industry 4.0 Revolution on the Human Capital Development and Consumer Behavior: A Systematic Review. *Sustainability*, *12*(10), 4035. https://doi.org/10.3390/su12104035

Szabo, Z. K., Körtesi, P., Guncaga, J., Szabo, D., & Neag, R. (2020). Examples of Problem-Solving Strategies in Mathematics Education Supporting the Sustainability of 21st-Century Skills. *Sustainability*, *12*(23), 10113. https://doi.org/10.3390/su122310113

Winstone, N. E., & Boud, D. (2022). The need to disentangle assessment and feedback in higher education. *Studies in Higher Education*, *47*(3), 656–667. https://doi.org/10.1080/03075079.2020.1779687