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The Effect Of The Problem Based Learning Model On Students' Mathematical Problem-Solving Abilities In Statistics Material In Grade VIII

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Abstract

This study aims to determine the effect of the Problem Based Learning (PBL) learning model on students' mathematical problem-solving abilities in Statistics material for grade VIII. The method used is Quasi Experiment with a pretest-posttest control group design. The research sample consisted of two classes, namely the experimental class consisting of 31 students who were treated with the PBL model and the control class consisting of 28 students who were taught with the conventional model. The research instrument was a mathematical problem-solving test in the form of descriptions that had been tested for validity and reliability. The results showed that the N-Gain value in the experimental class was 0.73 (high category), while in the control class it was 0.32 (medium category). The average posttest score of students in the experimental class was also higher than that of the control class. Hypothesis testing using the t-test produced a t-value of 13.858 > t-table = 2.8 with sig. = 0.000 < 0.05, which means there is a significant influence of the PBL model on students' mathematical problem-solving abilities. Thus, the application of PBL can be used as an effective alternative in mathematics learning to improve students' problem-solving abilities.

Keywords: *Problem Based Learning, mathematical problem solving, statistics*

INTRODUCTION

Education is seen as a vehicle for producing high-quality human resources (Handayani & Koeswanti, 2021) . Education is crucial for human life, as it guides people to develop their potential and abilities to address challenges. Education can also shape individuals into individuals with high morals and qualities. According to Wahyuni, Fauziah, Aisyah, & Al-Fayed (2023) , "Education aims to develop students' potential to become faithful, capable, creative, independent, and democratic and responsible citizens."

One area of education that plays a crucial role in improving the quality of education is mathematics. Mathematics is a vital and useful science in everyday life. Furthermore, it is inseparable from other sciences and technology. This is because mathematics can train a person to think logically, critically, creatively, and skillfully to solve problems in everyday life (Ramadhan, 2021) . Mathematics has a unique feature: it can be applied to other fields

of science, or it can be said that mathematics is the science of all sciences. This is in accordance with the opinion of (Alfianiawati, Desyandri, & Nasrul, 2019) who stated that "Mathematics, as the Queen of Sciences, plays a crucial role in science and technology. Therefore, as a subject, it must be taught to all students to develop logical, analytical, systematic, critical, and creative thinking skills, as well as the ability to collaborate with others."

In fact, until now the quality of mathematics education in Indonesia is still problematic in terms of ranking and mathematical literacy which is still low. This is in accordance with the results of the 2018 PISA (Program for International Student Assessment) survey which showed that Indonesia occupies a low position, namely 73rd out of 79 other countries in the survey (Asiyah & Ghofur, 2019). Many factors cause this to happen, including students still view mathematics as a scary subject, because students find it difficult to understand material that is abstract in mathematics (Nurcahyani, Wicaksono, & Fauzan, 2022) , students tend to think negatively about mathematics, lack of interest in learning, and lack of motivation (Hidayatul, Dafik, Tirta, Wangguway, & Suni, 2020) , and students are still weak in solving mathematical problems that involve mathematical literacy (Rohim, Dafik, Slamin, & Sucianto, 2019) .

One of the skills that students need to have in learning mathematics is problem-solving skills. Problem-solving skills are very important for students because by being able to solve a problem, students gain experience, use the knowledge and skills they already have to apply them in everyday life (Elita et al, 2019). Based on oral interviews with teachers at SMP Negeri 1 Stabat, it was stated that: "students still experience difficulties in solving a problem. When the teacher gives examples of problems to students, they can still understand the discussion given by the teacher. However, when the teacher gives several problems that are different from the examples, students experience difficulties in solving the problem.

Mathematical problem-solving ability is one of the achievements in the mathematics learning process. Problem-solving ability is a complex cognitive and thinking ability that includes the activities of analyzing, interpreting, reasoning, predicting, evaluating, reflecting on information and knowledge as well as previously applied to new situations so that problem solving can be completed. According to (Marbun, 2020) problem-solving is the ability to overcome mathematical difficulties by combining previously acquired mathematical concepts and rules to achieve the desired goal. And according to (Samadun & Dwikoranto, 2022) namely "Problem-solving is a basic ability in the learning process". Therefore, problem-solving is a very important aspect because it can encourage students to make the best decisions when facing problems in their lives, problem-solving is a process to overcome difficulties encountered in order to achieve a desired goal. Ramdan et al in (Ula Himatul Aliyah, 2014) .

Mathematical problem-solving skills are crucial in mathematics learning, as they can assist students in solving everyday problems and foster higher-order thinking. Hendriana, Rohaeti, and Sumarno (Darwati and Purana, 2021) explain that mathematical problem-

solving helps students develop critical thinking, a process that aims to enable us to make rational decisions, enabling us to correctly implement what we consider best about a truth, while fostering creative thinking and developing other mathematical skills.

However, in reality, students' mathematical problem-solving abilities are still relatively low (Asih, 2019). The low level of problem-solving abilities possessed by students is caused by many factors, including according to Gultom in (Wahyu Ariyani & Prasetyo, 2021) that "Low problem-solving abilities are a natural thing where so far the facts in the field show that the learning process that occurs is still conventional and centered on teachers who are only ready to be used without understanding the meaning of the formulas so that it hinders students' mathematical understanding and creativity", then according to "In learning, teachers never orient students to everyday problems that are close to students' lives and do not pay attention to students' problem-solving abilities." and according to (Nofziarni, Hadiyanto, Fitria, & Bentri, 2019) that "Students' inability in mathematical problems is because students have difficulty understanding the reading of problem texts, and when students solve problems, students are unable to make mathematical propositions." (Riskyanti, Hamid, & Jalal, 2022) .

One of the learning difficulties experienced by students is in statistics material, this material is a very important and fundamental science for everyday life because statistics is used in various fields of work. Learning statistical concepts plays a crucial role in the world of mathematics education and in human life. However, what is happening currently, students experience various difficulties and are also less able to understand a concept contained in statistical material. This statement is in accordance with research that has been conducted by Setyorini, Pramudya & Setiawan which states that students only understand partially or with differences in understanding certain concepts when students determine data distribution when viewed from quartile deviations, averages and standard deviations.

The lack of problem-solving skills of students causes students to only be able to work on routine problems or questions that are exactly the same as those given by the teacher, so that students are not used to non-routine questions or different questions that cause students to experience errors in solving mathematics problems. Sudirman & Zanthy in (Siagan, Saragih, & Sinaga, 2019) , shows that students are not used to working on problem-solving questions and students must be trained to work on questions in order to solve a problem-solving problem (Rahmawati, warmi, 2023) .

In an effort to improve mathematical problem-solving skills, teachers should have a breakthrough to train and accustom students to solving mathematical problems in everyday life. As stated by Pangaribuan and Manik in that "To improve the quality of education, various breakthroughs are needed, both in curriculum development, learning innovation, fulfillment of educational facilities and infrastructure so that students are challenged to learn in finding their own hypotheses, the active role of students is very much needed to support the success of mathematical problem-solving skills. One of the breakthroughs needed is through an approach that can stimulate students' mathematical problem-solving

skills in mathematics learning". In addition, according to states that a teacher must be able to choose and implement a certain mathematical learning approach besides they try to help students overcome difficulties to achieve mathematical problem-solving skills, and they also try to foster a positive attitude towards mathematics .

One approach that can be used to improve students' mathematical problem-solving abilities is the Problem-Based Learning approach. Mathematics learning with Problem-Based Learning (PBL) will make it easier for students to solve problem-based problems, because students are directly required to find their own answers to the problems that have been given by the teacher (Warr & West, 2020) . This learning begins by giving students problems and students are required to conduct investigations and analyze them to obtain solutions. By implementing the PBL model, students are encouraged to be actively involved in learning. In addition, by presenting real problems, it is hoped that students will find it easier to conduct investigations, both individually and in groups. Thus, students have indirectly used their mathematical problem-solving abilities through understanding and analyzing problems (Ramdan, Veralita, Rohaeti, & Purwasih, 2018) .

Based on the description above, the researcher is interested in conducting research with the title "The Effect of Problem Based Learning Model on Students' Mathematical Problem Solving Ability in Statistics Material in Class VIII of SMP Negeri 1 Stabat"

METHOD

This research was conducted at SMP Negeri 1 Stabat in the even semester of the 2024/2025 Academic Year. The type of research that will be used is quantitative research using a quasi-experimental research method (quasi-experiment), which aims to see the effect of the problem-based learning model on students' mathematical problem-solving abilities. In this study, a post-test control group design was used. In this design, the experimental class was given treatment (X) and after being given treatment, a test was given as a post-test (O) (Samad, 2021) .

"Population is the entire research subject." According to (Garaika, 2019), a population is a generalized area consisting of subjects/objects that have certain qualities and characteristics determined by the researcher to be studied and conclusions drawn. Therefore, the population in this study is all eighth-grade students of SMP Negeri 1 Stabat (Utami & Wutsqa, 2017) .

Meanwhile, a sample is a portion of the number and characteristics possessed by the population (Masruroh, Zaenuri, Walid, & Waluya, 2022) . The research sample used in this study was all 11th grade students. The technique used in this study was Cluster Random Sampling, a technique in which each class has an equal opportunity to be sampled. Therefore, the sample in this study consisted of two classes: one control class and one experimental class (Lukman, Setiani, & Agustiani, 2023) .

Data collection is a very important method to use in research, because the data obtained is used to test the formulated hypothesis. Therefore, in this study, data collection was carried out, namely: A test is a series of questions or exercises and other tools used to

measure the skills, knowledge, intelligence, abilities, or talents possessed by an individual or group (Azwardi & Sugiarni, 2019) . In this study, one test was carried out, namely a post-test given after being taught with the Problem Based Learning learning model. The test given was in the form of a description (essay test). This test was given to obtain data and measure students' mathematical problem-solving comprehension abilities after being given treatment (Berutu, Muhammad, & Herizal, 2021) .

RESULT AND DISCUSSION

Research result

The research was conducted at SMPN 1 Stabat located at Jl. Zainul Arifin No. 10 Kwala Bingai, Stabat District, Langkat Regency, North Sumatra, 20811. This research was conducted in class VII of SMPN 1 Stabat in the 2024/2025 academic year. From the total of 10 classes, 2 classes were taken as samples consisting of 59 students, where the experimental class was class VIII-A consisting of 31 students and the control class was class VIII-B consisting of 28 students. Before this research was conducted, the researcher first conducted a test given in class VIII-A of SMPN 1 Stabat in the 2024/2025 academic year consisting of 34 students. The aim was to obtain values from test validity, test reliability, question discrimination power, and question difficulty level (Adlha & Supangken, 2020) .

t-test

Hypothesis testing using the t-test is stated in the following table:

Table 1. N-Gain Results of Experimental Class and Control Class

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Standard Error Difference	Lower	Upper
Mathematical_Solving	Equal variances assumed	1,252	,268	13,858	56	,000	33.69048	2.43115	28,82031	38,56065

g_Resu lts	Equal variances not assumed	3,776	1 3,021	00	,0 69048	33. 44551	2. 8.7854	2 59551	38,

From the table above, the calculated t value is obtained of 13.858. For df = 58-2 = 56, the calculated t = 0.05 x 56 = 2.8 is obtained with a sig value of 0.00, so the data is declared significant, which means there is an influence of the *Problem Based Learning* learning model on increasing mathematical problem-solving abilities. (Raeda Abjad, Nurma Angotasan, 2022) .

Discussion of Research Results

This research was conducted in 2 meetings for classes VIII-A and VIII-B on (15-16 April 2025) in the odd semester of the 2024/2025 academic year for a group of 30 students in the experimental class and 28 students in the control class. (Fitrianingsih & Budiman, 2022) . Based on the results obtained from the data processing described in the previous section, it was concluded that the mathematical problem-solving abilities of students in the experimental and control classes were different (Astuti & Syafitri, 2020) . The results of this study concluded that the *Problem Based Learning learning model* had a higher effect on increasing mathematical problem-solving abilities than students who used conventional learning models because the *Problem Based Learning learning model* helped students develop critical thinking skills, problem-solving skills, and independent learning abilities. (Saputra, Sofyan, & Mardiani, 2023)

CONCLUSION

Based on the formulation of the problem and the proposed research hypothesis and the research results that have been analyzed, the conclusions in this research are:

1. There is an influence of the *Problem Based Learning Learning Model* on Students' Mathematical Problem Solving Ability in Statistics Material in Class VIII of SMP Negeri 1 Stabat in the 2024/2025 Academic Year.
2. The average *post-test results* on the mathematical problem-solving abilities of students using the *Problem Based Learning Model* were higher than those using the conventional learning model.

Suggestion

Based on the conclusions obtained from this research, the researcher provides several suggestions as follows:

1. Teachers must recognize each student's abilities, so that they are able to make good plans in learning to be able to overcome problems faced by students both in terms of time allocation and learning models for each material to be studied.
2. Students are expected to be more active in understanding questions, identifying problems, providing opinions, solving problems, and drawing conclusions in problem solutions.

3. There are limitations in carrying out this research, so it is recommended that there be further research on the *Problem Based Learning model* on other materials or other aspects.

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