The Influence of Problem Based Learning Model on Problem Solving Ability and Student Learning Motivation in Grade V Elementary School

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Abstract: Students have not been actively involved in finding their own concepts or learning materials. One effort that can be made is to use the Problem Based Learning model. This study aims to determine the effect of the Problem Based Learning model on students' problem-solving ability and learning motivation in Mathematics learning in Grade V of Elementary School. The type of research used is Quasi Experimental. The sample of this study was class Va students as the experimental class and class VB students as the control class. While to test the hypothesis using the independent t test. To determine the relationship between problem-solving ability and learning motivation, a correlation test was carried out. The results of this study indicate that there is an effect of the Problem Based Learning model on students' problem-solving ability and learning motivation in Mathematics learning in Grade V of Elementary School. Details of the data analysis results are: The results of the independent t test on problem-solving ability obtained a significant value of 0.761 for the pretest and 0.000 for the posttest. By taking a significance value of 5%, it is concluded that the Ha of this study is accepted, while H1 is rejected, meaning that there is an influence of the Problem Based Learning learning model on students' problem-solving ability in Mathematics learning; The results of the independent t test on learning motivation obtained a significance value of 0.588 for the pretest and 0.000 for the posttest.

Keywords: Learning motivation; Mathematics; Problem based learning; Problem solving ability

Introduction

Education is a conscious effort to realize a cultural inheritance from one generation to another. Education makes this generation a role model for the teachings of the previous generation. Until now, education has no limits to explain the meaning of education completely because of its complex nature, such as its target, namely humans. Education is a conscious and planned effort to create a learning atmosphere and learning process so that students actively develop their potential to have spiritual religious strength, self-control, personality, intelligence, noble morals and 21st century skills (Rahmah et al., 2020). Entering the 21st century, the quality of life of a nation is determined by education. According to Sucipto (2017), education must be designed to be able to equip students who are responsive to the challenges of the globalization era (Rocha et al., 2023). In facing these challenges, it is necessary to train students to be able to learn independently and develop their reasoning and thinking skills so that quality education is formed. Quality education cannot be separated from good mastery of mathematics. Mathematics education is not just memorizing formulas but also understanding concepts and their applications in everyday life

(Thanheiser, 2023). This is in line with Österman et al. (2019), learning mathematics is not only about calculating, but students are required to have thinking and reasoning skills in problem-solving skills that can be used in everyday life. This is used to train students to think critically, logically, systematically, analytically, carefully, and can use creative thinking patterns in everyday life (Bağ & Gürsoy, 2021).

Mathematical problems are given to students to train themselves in using their thinking skills, as well as to find out the position of the level of thinking that each student has. Solving mathematical problems is greatly influenced by the level of thinking skills possessed by students. Students are said to be able to solve a problem if the student is able to examine a problem and is able to use their knowledge in new situations. This ability is usually known as problem-solving ability. Problem solving is a process, method, action, breaking down or solving. The problem-solving approach is a learning approach where students practice solving problems. These problems are sometimes deliberately created by teachers, from problems that arise in students' daily lives.

The problem-solving approach refers to the development of children's brain function, developing creative thinking skills to recognize problems and find solutions (O'Reilly et al., 2022). However, in fact, the ability of the Indicator that shows the quality of education in Indonesia tends to be low is the results of international assessments of student achievement. one of them is the results of TIMMS and PISA. For example, the low problem-solving ability of Indonesian students in mathematics can be seen from the results of the TIMSS (Trends in International Mathematics and Science Study) survey in 2011, which placed Indonesia in 38th place out of 44 countries with a score of 386, below the standard score set at 500. This shows a decrease in the previous score in 2007, which was 394. PISA (Program for International Student Assessment) in 2012 placed Indonesia in 64th place out of 65 countries that took part. In the survey, one of the cognitive indicators was problem solving (Firmansyah et al., 2020).

Based on the results of observations conducted on August 26-30, 2024 in mathematics learning, it was found that there were problems in the mathematics learning process in the classroom, namely that when taking part in mathematics learning, students tended to get bored quickly and were less active in participating in learning in the classroom (Borgonovi et al., 2023). In addition, during the learning process, the teacher only delivered the material and students were only recipients of information without being trained to find their own concepts, so that students' thinking skills did not develop. Then, students had difficulty working on story problems, if given questions that were different from those taught by the teacher, students would be overwhelmed in solving them. The low problem-solving ability of students also affected students' learning motivation because if there was no motivation from students to learn, then students would never be interested in mathematics lessons and would not get satisfaction from learning mathematics and learning would be meaningless. This is in line with research (Schoenherr et al., 2025), the low motivation of students to learn is also proven based on data obtained by students in the low category (12 students) ranging from 40.6% to 44.6%, students in the medium category (9 students) ranging from 49.30% to 67.30% and students in the high category (5 students) ranging from 75.3%.

Meanwhile, research conducted by Metekohy et al. (2022), states that motivation is the basis for students to be able to obtain maximum learning outcomes, where further learning outcomes will be used as a basis for determining the achievement of expected competencies. The existence of good motivation in the learning process will also get good results. In the 21st century, student learning motivation has become a serious concern in developing students for problem solving (Aidoo et al., 2024). According to Urhahne et al. (2023), states that learning motivation is influenced by human needs which are arranged in levels. Basic needs such as physiological and safety needs must be met before a person can focus on higher needs such as social and esteem needs. The word motivation is defined as an effort to encourage someone to do something. The word motivation is defined as an effort to encourage someone to do something.

To improve students' problem-solving abilities and learning motivation, learning innovation is certainly needed. One of them is using the Problem Based Learning learning model. The theory put forward by (Yew & Goh, 2016), that Problem Based Learning is a learning model that focuses on solving problems through case studies. Problem Based Learning is designed to help students develop problem-solving skills, collaboration skills, independent communication skills in learning (Rehman et al., 2024). Since its discovery, Problem Based Learning has been applied in various fields, including education, medicine, engineering and business (Sutika et al., 2023). This model has been proven effective in improving understanding and application of concepts, as well as developing students' critical and creative thinking skills (Rachmayani et al., 2023). Problem Based Learning or problem-based learning is a learning model that emphasizes students' practical experience in solving complex and contextual problems. This model uses problems as the focus of learning, and students are asked to solve the problem. through cooperation in groups.

The steps of the Problem Based Learning learning model used by researchers in the opinion (Purwandari, 2023), that the steps of the Problem Based Learning model include: Orienting students to problems; organizing students; guiding individual and group investigations; developing and presenting work results; analyzing and evaluating the problem-solving process. The relationship between the Problem Based Learning learning model and problem-solving skills is that students are encouraged to develop critical and analytical thinking as they try to solve the given mathematical problems (Dewi et al., 2023).

By using real-world or contextual contexts in learning, Problem Based Learning helps students see the relevance of mathematical concepts in everyday life, while also increasing student involvement in the learning process (Ratnasari et al., 2017). With the Problem Based Learning learning model, students can understand learning materials more actively, innovatively, creatively and effectively so as to improve students' problem-solving abilities. Based on the problems that exist in schools, researchers are interested in conducting research entitled "The Effect of the Problem Based Learning Learning Model on Solving Ability and Problem Learning Motivation of Students in Mathematics Learning in Grade V Elementary Schools".

Method

The research to be carried out is a type of quantitative research. Data in quantitative research are in the form of numbers and analysis using statistics (Kotronoulas et al., 2023). The research method chosen is the experimental method using quasi-experimental design. Quasi-experimental design is often referred to as a pseudo-experiment. This method is considered a type of development of true experimental design, because it still involves variable manipulation, but does not fully control all external variables that may affect the results of the study. Sampling was taken using the "random sampling" technique. Simple Random Sampling is a technique for taking sample members randomly without considering the strata in the population.

The instrument used in this study was a questionnaire sheet, a questionnaire is a technique or method of collecting data indirectly where researchers do not directly ask questions to respondents. Furthermore, the test sheet, the test sheet as a data collection instrument is a series of questions or questions used to measure the skills, knowledge, intelligence, abilities, or talents possessed by individuals or groups. Data collection techniques in this study are observation, interviews, tests, and documentation. To collect initial data, researchers use data collection techniques through observation, interviews, and documentation activities.

The data analysis technique in this study is the t-test which is carried out after the prerequisite test of the t-test analysis is met.

Result and Discussion

Information about students' learning motivation was collected through pretest and posttest data in the form of a questionnaire consisting of 25 questions for both the control and experimental classes. The questionnaire sheet was compiled based on learning motivation indicators consisting of 5; diligent in doing assignments, showing high interest, preferring to work independently, being able to defend opinions, and always trying to achieve (Salguero-Pazos & Reyes-de-Cózar, 2023).

Table 1. Student Learning Motivation Data

	Control		Experiment	
	Pretest	Posttest	Pretest	Posttest
Mount	1031	1935	960.80	2235
Mean	39.66	74.43	38.43	89.40

Table 1 shows that the average pre-test score of students' learning motivation in the control class was 39.66, which is included in the poor category. Meanwhile, the average pre-test score in the experimental class was 38.43, which is in the very poor category. After implementing learning using the Problem Based Learning learning model, there was a significant increase in the post-test scores in both classes. In the control class, the average post-test score of students' learning motivation increased to 74.43, which is included in the good category. Meanwhile, in the experimental class, the average post-test score also increased to 89.40, which is included in the very good category. Information about problem-solving abilities was collected through pretest and posttest data in the form of essay test questions in the form of story questions arranged based on the question grid with a total of 5 test questions. The indicators of problem-solving abilities used in this study according to Grandis et al. (2023), are understanding the problem (understanding problem), planning the problem (devising a plan), carrying out the problem-solving plan (carrying out the plan), re-examining the solution obtained (looking back).

Table 2. Problem Solving Ability Data

	Control		Experiment	
	Pretest	Posttest	Pretest	Posttest
Amount	1122.50	1723.80	1100	1941.20
Mean	43.17	66.29	44.00	77.65

Table 2 shows that the average pre-test score of students' problem-solving ability in the control class was 43.17. Meanwhile, the average pre-test score of students' problem-solving ability in the experimental class was 44.00. These data indicate that before being given treatment, students' problem-solving ability in both classes was still in a relatively low category. After the implementation of the learning, there was an increase in the post-test results in both classes. The average post-test score of students' problem-solving ability in the control class increased to 66.29. While in the experimental class, the average post-test score reached 77.65. Hypothesis testing uses the Independent Sample t-Test to determine whether or not there is a difference in students' learning motivation and problem-solving ability in learning Mathematics between the control group and the experimental group. The Independent Sample t-Test uses significance values to make decisions. If the significance value is less than 0.05 then H0 is rejected and H1 is accepted.

Table 3. Independent Sample t-Test Learning Motivation

	Sig. (2-tailed)
Motivation to learn	0.000

Table 3 shows the results of the independent samples t-test of learning motivation against the post-test data above, the Sig. value is 0.000 <0.05, which means that there is a difference in learning motivation between control class students and experimental class students after the learning process. Thus, it can be concluded that the alternative hypothesis (H_1) in this study is accepted, while the null hypothesis (H_0) is rejected. These results indicate that the use of the Problem Based Learning model has a significant effect on students' learning motivation in Mathematics learning.

Table 4. Independent Sample t-Test of Problems Solving Ability

	Sig. (2-tailed)
Problem Solving Skills	0.000

Table 4 shows the results of the independent samples t-test on the post-test data of students' problem-solving abilities, obtained a significance value of 0.000 <0.05. These results indicate that there is a significant difference between students' problem-solving abilities in the experimental class and the control class after the implementation of learning. By considering the results of the t-test on both the pre-test and post-test data, it can be concluded that the alternative hypothesis (H_1) is accepted and the null hypothesis (H_0) is rejected. This means that the Problem Based Learning model has a

significant effect on students' problem-solving abilities in Mathematics learning. Correlation Test was conducted to determine the relationship between students' learning motivation and problem-solving abilities.

Table 5. Correlation Test

		Correlations	
		Motivation to learn	Solution to problem
Motivation to learn	Pearson Correlation	1	.748
	Sig. (2-tailed)		.000
	N	25	25
Solution to problem	Pearson Correlation	.748	1
	Sig. (2-tailed)	.000	
	N	25	5

Table 5 shows that the calculation with product moment correlation analysis obtained a sig value (2-tailed) of 0.000 <0.05. This shows that there is a significant relationship between students' learning motivation and problem-solving ability using the Problem Based Learning learning model in mathematics learning in grade V of elementary school. While the Pearson Correlation value between students' learning motivation and problem-solving ability is 0.748. To find out the strength or weakness of the level or degree of evenness of the relationship between variable X (learning motivation) and variable Y (problem-solving ability) can be seen from the correlation coefficient. The following is the calculation of the determination coefficient:

$$KD = r \times 100\% \tag{1}$$
$$KD = 0.748 \times 0.748 \times 100\%$$
$$KD = 55.90\%$$

The magnitude of the correlation or relationship (r) obtained is 0.748 and the percentage of the influence of variable X (learning motivation) on variable Y (problem-solving ability) or can be called the determination coefficient ($r2$) is 0.4748 (55.9%). Based on the results of the determination coefficient ($r2$) of 0.748, it can be interpreted that the relationship between learning motivation and problem-solving ability is 55.9%, and 44.10% is influenced by other variables outside the study. The above test shows that the significance level is 0.000 <0.05, which means that there is a positive and significant relationship between student learning motivation and problem-solving ability using the Problem Based Learning learning model in mathematics learning in grade V of elementary school. The N-gain test was conducted to determine the extent of the increase between before and after being given treatment between the two sample groups. Table 5 shows the

results of the percentage of Student Learning Motivation as follows:

Table 6. N-gain Test of Student Learning Motivation

	Group	Mean	Std. Error
N-gain Percentage	Control	0.580	
	Experiment	0.824	

Table 6 shows the results of the N-gain percentage test with an average N-gain percentage for the control group of 58.0% which is included in the medium category, while the average N-gain percentage for the experimental group was 82.4% which is included in the high category.

Tabel 7. N-gain Test of Problem Solving Ability

	Group	Mean	Std. Error
N-gain Percentage	Control	0.400	
	Experiment	0.800	

Table 7 shows the results of the N-gain percentage test with an average N-gain percentage for the control group of 40.0% which is included in the moderate category, while the average N-gain percentage for the experimental group was 80.0% which is included in the high category. The use of learning models in the learning process is considered important because it can guarantee learning in accordance with the expected objectives. The Problem Based Learning learning model has several advantages as an alternative approach in learning Mathematics. Among them are students are encouraged to develop problem-solving skills in real situations, students are able to build their own knowledge through learning activities, learning focuses on problems, so that irrelevant material does not need to be learned, reducing the burden on students in memorizing or storing information, individual learning difficulties can be overcome through group work in the form of peer teaching (Martin-Alguacil et al., 2024; Mende et al., 2021).

The Effect of the Problem Based Learning Learning Model on Problem Solving Ability

The problem-solving ability test is compiled based on problem-solving indicators, namely: understanding the problem, being able to plan a solution, being able to use or develop problem-solving strategies, and re-examining the solutions obtained. Based on the results of the independent samples t-test, the Sig. 2-tailed posttest problem-solving ability value is 0.000 <0.05, which indicates that there is a difference in the average problem-solving ability between the two classes after the treatment. This can be seen from the average problem-solving ability of students in the experimental class increasing from 44.00 to 77.65, while in the control class

it only increased from 43.17 to 66.29. This study is in line with research Tahir (2020), in his research at the junior high school level, that students who took part in learning with the PBL model obtained a higher average problem-solving ability score compared to the control class using the lecture method. The average score of the experimental class reached 82, while the control class was only 68. This shows that PBL is effective in encouraging students to think critically and actively in solving problems independently. In line with that, research conducted by Siregar et al. (2023), that the PBL model is applied to mathematics subjects in high school. The results showed that the experimental class gained a 27% increase in problem-solving ability, while the control class only increased by 13%. PBL encourages students to actively seek information and develop various problem-solving strategies, in contrast to the control class which tends to be passive and dependent on the teacher.

The Influence of Problem Based Learning Model on Students' Learning Motivation

Learning motivation is the overall driving force within students that causes learning activities, which ensures the continuity of these learning activities and provides direction to learning activities so that the desired goals can be achieved. In this study, learning motivation was observed through several indicators, namely: Diligent in doing assignments; Showing high interest; Preferring to work independently; Being able to defend opinions; and always trying to achieve. Based on the results of the independent samples t-test, the Sig. 2-tailed posttest value of students' learning motivation is 0.000 <0.05, which means that there is a significant difference in learning motivation between the two experimental classes after being given treatment. The increase in students' learning motivation in the experimental class is clearly visible both from the results of quantitative data and observations of students' learning motivation. The average learning motivation of students in the experimental class increased from 38.43 to 89.40, while in the control class it only increased from 39.66 to 87.71. Student learning motivation is an important factor that drives increased learning outcomes and problem-solving abilities.

When students have high motivation, they tend to be more focused, persistent, and active in the learning process. This makes them more enthusiastic to understand the material in depth and not give up easily when faced with difficulties (Rigusti & Pujiastuti, 2020). In line with Hamdani et al. (2022) stated that strong motivation also encourages students to develop effective learning strategies, such as looking for additional learning resources or discussing with friends and teachers, so that their analytical and problem-solving

skills are increasingly honed. In other words, good learning motivation creates a positive attitude towards learning which leads to increased academic achievement and critical and creative thinking skills in solving various challenges. Therefore, fostering learning motivation is very important to create optimal learning outcomes and better problem-solving skills in students.

The Relationship between Problem-Solving Ability and Student Learning Motivation Using the Problem Based Learning Learning Model

The magnitude of the relationship between problem-solving ability and elementary school students' learning motivation in this study was determined through a correlation test. Based on the test results, a significance value of 0.000 <0.05 was obtained, which means that there is a significant relationship between problem-solving ability and learning motivation. In conclusion, there is a significant relationship between problem-solving ability and students' learning motivation using the Problem Based Learning learning model in Mathematics learning in Grade V of Elementary School. Learning motivation is an important element in supporting the development of students' problem-solving abilities, because it can move behavior in a positive direction so that they are able to face all demands and difficulties in learning (Cronin-Golomb & Bauer, 2023; Wijnia et al., 2024). Motivation as the main factor in learning functions to generate, underlie, and drive learning activities (Jeno et al., 2023; Dahri et al., 2024).

Students who are highly motivated will be diligent in trying, appear brave, not willing to give up, and actively read to improve learning outcomes and solve the problems they face (Sukendra & Yuliastini, 2019). Several studies have shown a close relationship between increasing learning motivation and problem-solving abilities. Hasrawati et al. (2020), and Chaiyarat (2024), revealed that increasing students' learning motivation has a significant impact on problem-solving abilities. When students are motivated, they tend to have a greater interest in learning materials and show high curiosity. This encourages them to be more active in seeking information, understanding concepts in depth, and trying various approaches in solving tasks or problems faced. Reinforced by Schöpfer & Hernandez, (2024), and Southworth, (2022), that strong motivation encourages individuals to actively think critically, try various strategies, and not give up easily when facing difficulties. Thus, problem-solving abilities will also develop because the learning process is based on a strong desire to overcome challenges and find solutions (Harsela & Asih, 2020; Juwita et al., 2020).

Conclusion

Based on the research results that have been presented, it can be concluded that: there is an influence of the Problem Based Learning model on students' learning motivation in Mathematics learning in Grade V of Elementary School; there is an influence of the Problem Based Learning model on problem-solving abilities in Mathematics learning in Grade V of Elementary School; Learning motivation has a relationship with students' problem-solving abilities in Mathematics learning in Grade V of Elementary School.

Conflict of Interest
There is no conflict of interest related to the publication of this article. This statement ensures transparency and integrity of the publication process confirming that the findings are presented impartially and without external influence.

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