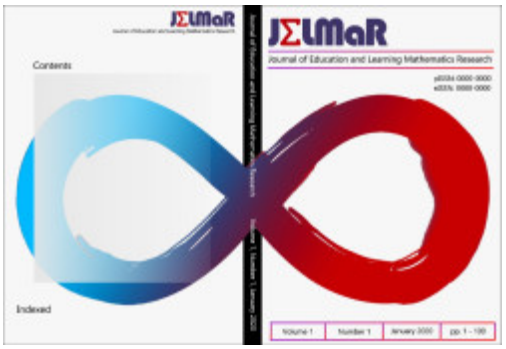

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Increasing Mathematical Problem-Solving Ability Through Models Problem-Based Learning on Cube and Block Material

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***Abstract**: This research aims to improve students' mathematical problem-solving abilities through models of problem-based learning. This research is classroom action research (PTK) conducted on 29 students in class VII.4 of SMP N 61 Palembang. Classroom action research is planned in two cycles. Each cycle goes through four stages of activity, namely planning, action, observation and reflection. Indicators of this research include understanding the problem, planning, solving the problem and interpreting the results obtained. The results obtained from this research in cycle I was through the model problem-based learning achieved an average score for the mathematical problem-solving ability of 70 in cycle I, while in cycle II it was 79.66. Based on these results it can be concluded that the model problem-based learning can improve students' mathematical problem-solving abilities in cube and block material.*
Keyword: mathematical problem-solving ability, problem-based learning, classroom action research

INTRODUCTION

Education is very important for human life (Aprima & Sari, 2022). Education has a big influence on the development of a country which is something urgent that deserves full attention and focus on improving the quality of education, especially for the younger generation (Ritonga, 2022). Currently, technological developments are having an impact on education (Sukmawarti et al., 2022). Through education, students are prepared to face the era of the Industrial Revolution which demands 21st-century skills, namely Creativity and innovation (creativity and innovation), Collaboration (Collaboration), Critical thinking and Problem-Solving (critical thinking and problem solving), and Communication (communication) (Sari & Tanjung, 2022). In the educational environment, mathematics is one of the subjects that can improve human resources related to solving problems to develop students' way of thinking in solving abstract and real problems in everyday life.

Problem-solving ability is a process for overcoming the difficulties faced to achieve the expected goals. Suryadi et al stated that problem-solving ability is one of the mathematical activities that is considered important by both teachers and students at all levels from elementary school to high school (Dwita Imannia et al., 2022). Furthermore, Rahman and Ahmar said that the ability to solve mathematical problems (Muksin et al., 2020) is one of the abilities that students must have to realize the importance of mathematics in everyday life. This is in line with the Minister of National Education Regulation no. 22 of 2006, one of the objectives of which is to solve problems, including how students understand problems, plan mathematical approaches, solve problems, and reinterpret the results they have obtained. Learning to solve problems is the main point why students should study mathematics as stated by NCSM (National Council of Supervisors of Mathematics).

The importance of student's ability to solve problems was emphasized by Sumarmo that the aim of learning mathematics and the heart of mathematics is problem-solving (Dwita Imannia et al., 2022). This is because, in the problem-solving process, students also try to learn about unknown concepts so that students can make this learning a learning experience with problems/questions with the same weight. Skills in solving

mathematical problems are certainly not easy, not only can they answer the problems given, but students are required to understand the problem, design mathematical models, complete plans, and interpret the solutions obtained (Hermawati et al., 2021).

Based on the facts, there are still many students who have not used mathematical problem-solving skills correctly and are in the low category. The results of the observations were carried out in the form of an initial test of mathematical problem-solving abilities in classroom building material for class VII.4 SMP N 61 Palembang, can be seen in Table 1 below.

Table 1. Student Initial Test Results Scores

No	Aspects of Mathematical Problem-Solving Ability	Present
1	Understanding the Problem	10,34%
2	Planning a Solution	51,72%
3	Implement a Settlement Plan	0%
4	Interpret the results obtained	0%

The initial test results show that every aspect of mathematical problem-solving ability is still relatively low. The aspect of understanding problems is often not writing down what is known and asked. Some students are accustomed to making mathematical models at the solution-planning stage. At the time of planning the completion, there was no complete and systematic solution, this was because students did not carry out these stages well. Meanwhile, in the aspect of interpreting the results obtained, students have not written the correct conclusions.

The low ability to solve mathematical problems cannot be separated from mathematics learning activities. So far, it seems that the mathematics learning process does not touch the substance of problem-solving. Students tend to memorize mathematical concepts so that students' mathematical problem-solving abilities are very poor (Dwita Imannia et al., 2022). Students are not encouraged to look for their ideas, only teachers always play an active role in the teaching and learning process. The formation of students' mathematical understanding will provide benefits for students if it involves solving problems that occur in everyday life as stated by Surya (Nasution et al., 2017)

Several relevant studies have examined mathematical problem-solving abilities associated with other learning models, namely: Multi-representational discourse and reciprocal learning (Tristiyanti & Afriansyah, 2016); Creative problem-solving and resource-based learning (Sopian & Afriansyah, 2017); And Guided Inquiry and Learning trajectory (Kurniawati & Rizkianto, 2018).

Responding to this problem, innovation in learning also needs to be carried out in learning models. One of the mathematics learning processes that can be applied in schools to improve mathematical problem-solving abilities is modeling problem-based learning (PBL). PBL is learning in nature and student-centered in solving contextual problems to stimulate students to learn. Model problem-based learning It is hoped that it can improve the mathematical problem-solving abilities of class VII.4 students at SMP N 61 Palembang on cubes and blocks.

METHOD

The research carried out was Classroom Action Research (PTK). The PTK implementation activity procedure is carried out in two cycles. Each cycle consists of 3 meetings (2 action meetings; and a mathematical problem-solving ability test meeting). The implementation consists of four stages in PTK referring to the theory put forward by Arikunto (2015), namely: (1) action planning stage, (2) implementation stage in the form of applying the PBL model, (3) observation/evaluation stage, and (4) reflection stage.

This research was carried out on March 2 to March 30 2024 at SMP N 61 Palembang with 29 students who have heterogeneous abilities. Research support is in the

form of research instruments (teaching modules and LKPD) and data collection instruments (teacher and student activity sheets and mathematical problem-solving ability test questions).

Table 2. Mathematical Problem-Solving Ability Scoring Rubik

Indicator	Information	Score
Understand the problem	Not answering	0
	Writing is known and asked but is wrong or does not understand the problem	1
	Understand the problem or information but it is incomplete	2
	Understand the problem or information thoroughly and precisely	3
Develop a solution plan	no effort to understand the problem	0
	There are efforts to create a resolution plan but it is not yet clear	1
	All settlement planning is correct without errors	2
Implement the plan	Lack of effort to understand and resolve problems	0
	There is a solution but wrong	1
	There is an answer according to the correct plan but there is an error in the calculation	2
	Correct answer with correct and correct solutions	3
Interpret the results obtained	There is no attempt to write a conclusion	0
	Make an interpretation of the results accompanied by a conclusion but not accurate	1
	Make interpretations accompanied by appropriate conclusions	2

Source: (Mawaddah & Anisah, 2015)

Narrative descriptive techniques are applied to process teacher and student activity data. The learning process is said to be improving if each learning step increases with each meeting. Meanwhile, data on students' mathematical problem-solving abilities was obtained from essay test results. The scoring guidelines used to measure students' mathematical problem-solving abilities for each indicator can be seen in Table 2 above.

The percentage of student completeness for each aspect is calculated using the formula:

$$\boldsymbol{Presentase = \frac{The\ number\ of\ students\ who\ got\ the\ maximum\ score}{Total\ number\ of\ students} \times 100\%}$$

Next, an analysis of the qualifications of mathematical problem-solving abilities is carried out by the scoring guidelines, and the maximum score percentage is found by converting it using the formula:

$$\boldsymbol{final\ score = \frac{Scores\ obtained\ by\ students}{Maximum\ score}}$$

Qualifying mathematical problem-solving ability scores are adjusted to the categories according to Mawaddah & Anisah, 2015 as follows:

Table. 3 Assessment Criteria

No	Value range	Mark	Information
1	85-100	A	Very good
2	70-84	B	Good
3	55-69	C	Currently
4	40-54	D	Less
5	<40	E	Very less

Source: (Mawaddah & Anisah, 2015)

The increase in the average value of students' mathematical problem-solving abilities before and after the action was then analyzed classically; After tabulating the

data, the average value of mathematical problem-solving ability is calculated using the formula:

$$\tilde{x} = \frac{\sum x_i}{n}$$

Information:

$\tilde{x}$= average answer score

x_i= i-th data value

n = lots of data

The success of the action with the suitability of the learning in the teaching module is a benchmark for increasing the success of the process while increasing the score in each cycle is a determinant in increasing mathematical problem-solving abilities. Viewed from the aspect of mathematical problem-solving ability, it can be said to be successful if process improvements and classical improvements occur after the action.

RESULT AND DISCUSSION

The research was carried out in two cycles where each cycle consisted of 3 meetings (2 action meetings and 1 final test meeting). Tests of students' mathematical problem-solving abilities are given at the third meeting of each cycle. The final test results in cycle I are as in Table 4.

Table 4. Cycle I Test Results

	Aspects of Mathematical Problem-Solving Ability							
	Understanding the Problem		Planning Problems		Implementing the Plan		Interpreting Results	
	n	%	n	%	n	%	n	%
0	0	0%	0	0 %	0	0%	17	58,62%
1	1	3,45%	4	13,79%	1	3,45%	12	41,38%
2	9	31,03%	25	86,21%	24	82,76%	0	0%
3	19	65,52%			4	13,79%		

Based on the analysis of the first cycle test results from several indicators that have been tested with material on the properties and meshes of cubes and blocks, it can be seen that the aspects of implementing plans and interpreting the results are in a low category because some students have not been able to come up with ideas in completing problems are given and students cannot interpret the answers they have worked on correctly. Therefore, action was taken as corrective steps in the implementation of the next cycle of learning.

Cycle II is carried out like cycle I by PBL syntax by paying attention to the deficiencies in cycle I. The test results in cycle II are shown in Table 5.

Table 5. Cycle II Test Results

	Aspects of Mathematical Problem-Solving Ability							
	Understanding the Problem		Planning Problems		Implementing the Plan		Interpretation of Results	
	n	%	N	%	n	%	n	%
0	0	0%	0	0%	0	0%	4	13,79%
1	0	0%	3	10,34%	2	6,90%	21	72,41%
2	5	17,24%	26	89,66%	17	58,62%	4	4,00%
3	24	82,76%			9	31,03%		

The data above shows that the test results of students' mathematical problem-solving abilities in cycle II on the surface area and volume of cubes and blocks also increased after taking action by applying the model. problem-based learning in the learning process. In cycle II, the aspect that showed a relatively high increase in mathematical problem-solving abilities compared to cycle I was problem understanding with an average of 65.52% to 82.76%.

Action research was carried out in two cycles, where each cycle had 3 meetings, the next step was to carry out a final test with cubes and blocks as material. The final results of the mathematical problem-solving ability test are shown in Table 6.

Table 6. Final Test Results

	Aspects of Mathematical Problem-Solving Ability							
	Understanding the Problem		Planning Problems		Implementing the Plan		Interpretation of Results	
	N	%	n	%	n	%	n	%
0	0	0%	0	0%	0	0%	0	0%
1	0	0%	0	0%	0	0%	24	82,76%
2	3	20,34%	29	100%	9	31,03%	5	17,24%
3	26	89,66%			20	68,97%		

Based on the data above, it can be seen that each indicator has increased. Although there are still students who have not carried out the problem-solving process according to the steps for solving mathematical problems, this number is much smaller and there has been an increase.

Model problem-based learning can have a positive influence on each cycle. The improvement that occurs in every aspect shows that each cycle has experienced improvement. Students have been able to analyze and find solutions to contextual problems. This can be seen from each indicator used as a reference. The analysis of the qualifications of mathematical problem-solving abilities in the initial test to the final test can be seen in Table 7. As follows:

Table 7. Increase On Each Qualifying Frequency
Students' Mathematical Problem-Solving Ability

No	**Value range**	**The number of students**				**Information**
		Initial Test	**Cycle I**	**Cycle II**	**Final Test**	
1	85-100	0	1	9	22	Very good
2	70-84	2	21	19	7	Good
3	55-69	7	5	1	-	Currently
4	40-54	17	2	-	-	Less
5	<40	3	-	-	-	Very less

The data above shows that the model problem-based learning can have a positive influence on increasing students' mathematical problem-solving abilities in each cycle. The analysis of increasing students' classical mathematical problem-solving abilities is shown in Table 8.

Table 8. Increase In Average Value
classical mathematical problem-solving abilities

Students' Mathematical Problem-Solving Ability Scores

	early	Cycle I	Cycle II	End
Average score	50	70	79,66	87,59
Enhancement		20	9,66	7,93

Overall mathematical problem-solving abilities increased after being given action in each cycle. This can be seen in Table 8. The student's mathematical problem-solving ability score in the initial test was 50, in cycle 1 it increased by a score of 20, in cycle II it was 9.66, and in the final test it increased by a score of 7. 93.

CONCLUSION

Based on the observations and discussions that have been carried out, it can be concluded that the model problem-based learning influences students' mathematical problem-solving abilities. This can be proven by an increase in scores from cycle I, namely 70 to 79.66 in cycle II.

Model problem-based learning can be a good alternative to improve the learning process and increase mathematical problem-solving abilities while still setting the right time to get maximum results.

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