



Application of Problem-Based Learning Model to Improve Mathematical Problem-Solving Ability of Class VII-B Students of MTs PP Nurul Huda Lubuk Batu Jaya

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ABSTRACT

This classroom action research aims to improve the problem-solving process and students' mathematical problem-solving skills by applying the Problem Based Learning model. The subjects in this study were class VII-B students of MTs PP Nurul Huda Lubuk Batu Jaya in the even semester of the 2021/2022 school year, totaling 24 students. This study consisted of two cycles, each consisting of four stages: planning, implementation, observation, and reflection. The research instruments used were learning devices and data collection instruments. Learning tools consist of a syllabus, lesson plan (RPP), and student activity sheets (LAS), while the data collection instruments used are observation sheets and KPMM tests. Data from the observation sheet shows that the learning process has improved from cycle I to cycle II. The average KPMM score of students in the first cycle was 68.61, increasing to 86.36 in the second cycle. Based on the results obtained, it can be concluded that the Problem Based Learning model can improve the learning process and the mathematical problem-solving abilities of class VII-B MTs PP Nurul Huda Lubuk Batu Jaya students in the even semester of the 2019/2020 school year.

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INTRODUCTION

Mathematics is the basic science of all sciences, so mathematics is considered the mother of science. Mathematics is a universal science that has an important role in various disciplines, which is very useful for human life and underlies modern technology's development [1]. In learning mathematics, students are required to think critically and logically, so mathematics is a subject that strongly emphasizes the importance of systematic, logical, analytical, creative, and collaborative thinking skills.

These abilities are contained in the objectives of learning mathematics in the 2013 curriculum, namely: (1) training how to think in understanding mathematical concepts, explaining the interrelationships between concepts and applying concepts appropriately in problem-solving; (2) using patterns as conjectures in solving problems, and performing mathematical manipulations in making generalizations based on existing problems or data; (3) use reasoning on the nature and perform mathematical manipulation in problem-solving which includes the ability to understand problems, build mathematical models, complete models and interpret the solutions obtained; (4) develop the ability to communicate ideas to clarify problems; (5) have an attitude of appreciating the use of mathematics in everyday life; (6) have attitudes and behaviors that are in accordance with the

values in mathematics; (7) perform motor activities using mathematical knowledge; (8) using simple teaching aids [2]. Based on the objectives of learning mathematics, one of the abilities that students must have is the ability to solve mathematical problems (KPMM).

Branca said that it is very important for students to have mathematical problem-solving skills because (1) problem-solving is the general goal of teaching mathematics; (2) problem-solving, which includes methods, procedures, and strategies is the core and main process in the mathematics curriculum; (3) problem solving is a basic ability in learning mathematics [3]. Meanwhile, Mayer in says that Mathematical Problem Solving Ability is a process with many steps in which the problem solver must find a relationship between a long-accepted experience and the problem he is currently facing and then act to solve it [4]. Rick Hunter Simanungkalit states that mathematical problem-solving ability is the ability of students to solve non-routine math problems using clear and correct completion steps [5]. Mathematical problem-solving ability in this study refers to the indicators proposed by Karunia Eka Lestari & Mokhammad Ridwan Yudhanegara [6]: understanding problems, planning problem-solving, implementing the problem-solving plans, and interpreting the results obtained. Experience using existing or existing knowledge and skills to be applied to solving a problem.

To find out how far the KPMM of grade VII-B students of MTs PP Nurul Huda Lubuk Batu Jaya was, the researcher gave an initial KPMM test. Problem-solving refers to the stages in the mathematical problem-solving process. The results of the KPMM assessment for grade VII-B students at MTs PP Nurul Huda Lubuk Batu Jaya using the KPMM scoring guidelines can be seen in the following table.

Table 1. Percentage of Students Who Got the Maximum Score in Each Aspect of KPMM

No	Aspects of KPMM that are measured	Number of students who can fulfill aspects	Percentage
1	Understanding the problem	17	70,8%
2	Planning problem solving	2	8,3 %
3	Implementing a problem-solving plan	-	-
4	Interpret the results obtained	-	-

Through the table of the percentage of students who got the maximum score on each aspect of the KPMM in the initial test, it can be seen that the KPMM of students is still low. Students are still not able to solve the questions well in every aspect. The percentage of understanding the problem is 70.8%, where only 17 students can write down what is known and asked correctly, four students write what is known and asked but are not precise, and three students write what they know without writing what was asked or asked. On the contrary, the percentage in the planning aspect of problem-solving is 8.3%, where only two students can plan problem-solving by making mathematical models correctly, 11 students plan problem-solving by making mathematical models but not precise, and 11 students were not planning problem-solving at all. The percentage of implementing the problem-solving plan is 0%, where 18 students do not write down problem-solving, and six students write down half or partially correct solutions. The percentage of interpreting the results is 0%, where 18 students do not write conclusions and six students interpret the results obtained by making conclusions but are less precise.

After seeing the initial KPMM test results for class VII-B MTs PP Nurul Huda Lubuk Batu Jaya, the researchers interviewed three students. When asked about the difficulty level of the

questions, students said that the questions given by the researcher were very difficult, and students did not understand how to solve them. Then when asked about learning in class, students said that mathematics was boring, and they could not solve problems in the form of stories because of students lack of knowledge in solving problems in the form of problems. Students also do not want to ask questions during the learning process due to feelings of shame and fear of being scolded by the teacher.

In addition to conducting interviews with students, the researchers also conducted interviews with the mathematics teacher class VII-B MTs PP Nurul Huda Lubuk Batu Jaya to find out the cause of the low KPMM of students. Some students are less active during the learning process and pay less attention when the teacher explains the lesson. Students still depend on the teacher's explanation, and there are still students who only copy answers from their competent friends, which results in misunderstanding the concepts learned and not achieving the learning objectives on that day. Students are less trained in solving problem-solving problems, so students have difficulty in solving problem-solving problems.

Furthermore, the researchers conducted observations in class VII-B MTs PP Nurul Huda Lubuk Batu Jaya. This is done to find things that need to be improved during the learning process. Based on the results of observations made by researchers, the teacher begins the lesson by greeting, guiding students to read prayers together, asking about students' attendance, and conveying apperception by asking questions that relate previous knowledge to the material to be studied. The teacher conveys learning motivation. The teacher informs the scope of the material to be studied.

In the core activity, the teacher explains the material to be studied to students in front of the class. After the teacher's explanation was finished, the students took notes in the notebook. Students also have not used the Student Activity Sheet (LAS) during the learning process. Next, the teacher gives examples of questions in the student textbook. When solving problem-solving problems, students have difficulty understanding the problem, making mathematical models, and solving them. Some students even seem reluctant to solve problems they think are difficult, so they only rely on other friends' answers or wait for an explanation from the teacher without trying to find solutions to the problems they face.

The core activities should use learning models, learning methods, learning media, and learning resources that are adapted to the characteristics of students and subjects [7]. In contrast, from the learning carried out by teachers, it can be seen that the learning model used is still conventional. Trianto states that in conventional learning, teachers still dominate learning activities (teacher-centered) [8]. Teachers explain the subject matter in textbooks so that students are passive and tend to receive knowledge without being allowed to develop independently and build knowledge through discovery in the thought process.

Based on the problems described, then in the learning process, it is necessary to make improvements to increase the KPMM of students. In efforts to improve students' mathematical problem-solving skills, teachers can do to apply appropriate learning models that can be used to optimize students' ability to solve problems. One of the learning models that can direct students to problem-solving activities in everyday life (contextual) is working together in groups to solve a given problem with an active and fun atmosphere, so student-centered learning is a Problem Based Learning (PBL) model.

M. Hosnan states that PBL or problem-based learning model uses unstructured and open real (authentic) problems as a context for students to develop problem-solving skills and critical thinking

and build new knowledge [9]. Students critically identify relevant information and strategies and conduct investigations to solve these problems. The Directorate General of Teachers and Education Personnel states that the PBL syntax consists of five main phases, namely: (1) student orientation to problems; (2) organizing students to learn; (3) guiding individual and group investigations; (4) develop and present the work; (5) analyze and evaluate the problem-solving process [10]. Arends (in Jamil Suprihatiningrum, 2016) states that the PBL model has the following characteristics: (1) Asking questions or problems; (2) Focusing on inter-discipline linkages; (3) Authentic investigation; (4) Producing products and displaying them; and (5) Collaboration.

This is in line with research conducted by Asria Hirda, which states that applying the Problem Based Learning model increases the KPMM for Lubuklinggau Junior High School students [11]. This is also supported by the research results of Christina Monika Samosir that the application of the PBM model can improve the learning process and improve students' mathematical problem-solving abilities [12].

Based on this explanation, to solve problems in learning mathematics in class VII-B MTs PP Nurul Huda Lubuk Batu Jaya, researchers conducted research by applying the PBL model to improve the learning process and improve mathematical problem-solving abilities of students in class VII-B MTs PP Nurul Huda Lubuk Batu Jaya in the even semester of the 2021/2022 school year on the subject matter of social arithmetic. The selection of the subject matter of social arithmetic is due to the problems related to this material that is often found in everyday life, so the PBL model is suitable for learning. This is in line with Friantini's opinion, which says that social arithmetic is a branch of mathematics often encountered in everyday life [13]. The subject matter of social arithmetic will use contextual problems as a trigger for the learning process. Students are expected to have problem-solving skills through contextual problem-solving.

METHODS

The form of the research is collaborative Classroom Action Research (CAR), namely researchers and mathematics teachers for class VII-B MTs PP Nurul Huda Lubuk Batu Jaya working together to implement the action. According to Suharsimi Arikunto, classroom action research is carried out through four stages: planning, implementing, observing, and reflecting [14]. The research conducted by the researcher consisted of two cycles where each cycle consisted of three meetings and one test of mathematical problem-solving ability.

The learning process in the classroom in this research is through action by applying the Problem Based Learning model. The subjects of this study were students of class VII-B MTs PP Nurul Huda Lubuk Batu Jaya in the even semester of the 2021/2022 academic year, as many as 24 students consisting of 12 male students and 12 female students. The instruments used in this research are learning devices and data collection instruments. Learning tools consist of the syllabus, lesson plans, and LAS. The data collection instruments were observation sheets for teacher and student activities and student KPMM tests.

Data analysis on improving the learning process is based on observation sheets during the learning process. At this stage, those who observe the teacher's activities are the mathematics teachers of class VII-B MTs PP Nurul Huda, and the observers of student activities are research colleagues. Observations were made from initial activities, core activities to final activities, then the results were described in detail on the observation sheet. Data from observations of teacher and student activities on the observation sheet is then analyzed, where the data is qualitative and analyzed by descriptive-narrative analysis technique.

Data analysis of students' problem-solving ability test results in cycles I and II were analyzed quantitatively. In the analysis of the achievement of the aspect of mathematical problem-solving ability, it will be seen how the achievement of the aspect of mathematical problem-solving ability after the first cycle and the achievement of the mathematical problem-solving ability aspect after the second cycle. The stages carried out in the analysis of the achievement of the aspect of mathematical problem-solving ability are: (1) providing an answer score for each aspect with scoring guidelines; (2) finding the percentage of the number of students who get the maximum score in each aspect by using the formula:

$$P = \frac{JM}{JS} \times 100\%$$

P : Percentage of students who got the maximum score

JM : The number of students who got the maximum score

JS : Total number of students

The analysis of the qualifications of students' mathematical problem-solving abilities before and after the action went through the following stages, namely: (1) giving students' answer scores according to the scoring guidelines used and then converting into students' KPMM scores with a scale of 0 - 100; (2) the conversion of students' KPMM scores using the formula:

$$n = \frac{sp}{sm} \times 100$$

n : final value

sp : acquisition score

sm : maximum score

The KPMM value obtained is then qualified according to the following table.

Table 2. Criteria for Students' Mathematical Problem-Solving Ability

No	Score Interval	Criteria
1	85,00 – 100	Very Good
2	70,00 – 84,99	Good
3	55,00 – 69,99	Enough
4	40,00 – 54,99	Not Enough
5	0 – 39,99	Very Less

The success criteria for the action's success are marked by an improvement in the learning process and an increase in student KPMM. An improvement in the learning process occurs if the activities of teachers and students have increased, where the learning process is getting better from cycle I to cycle II. In addition, there is a match between the steps in implementing the planned Problem Based Learning (PBL) model with the implementation of actions in the learning process which can be seen from the observation sheet for each meeting. The observation sheet of teacher and student activities becomes the basis for the results of reflection on the improvement of the learning process that will be carried out. Through the results of the reflection, it can be analyzed the weaknesses and deficiencies found must be corrected by drawing up an improvement plan. Process improvement can be seen from implementing the learning improvement plan in cycle I to cycle II.

The increase in students' mathematical problem-solving abilities can be seen from the analysis of students' KPMM tests where students' mathematical problem-solving abilities are said to increase if: (1) the number of students who get the maximum score on each aspect of KPMM increases, (2) the number of students who score with good criteria or very good more and more while students who get scores with less and less criteria are less and less, (3) the average student KPMM score increases classically from the basic score to the KPMM test score in the first cycle and the KPMM test score in the second cycle.

RESULTS AND DISCUSSION

Analysis of data on teacher and student activities shows that the quality of implementing the Problem Based Learning model is increasingly in line with learning planning, and the learning process is also getting better. Analysis of the learning steps in cycles I and II showed an improvement in the learning process in class VII-B MTs PP Nurul Huda Lubuk Batu Jaya on the subject matter of social arithmetic in the even semester of the 2021/2022 school year. This is in line with the opinion of Wina Sanjaya, which says that Classroom Action Research is said to be successful if the problem being studied is getting narrower or through the actions of each cycle, the problem is increasingly solved [15]. Based on the observation sheet during the learning process in class VII-B Mts PP Nurul Huda Lubuk Batu Jaya, most students' participation is getting more active in every step of solving problems. The application of the Problem Based Learning model by researchers positively influences the implementation of the learning process. Students are also trained to build their knowledge so that learning becomes more attached to students' memories. This influences students' KPMM.

The analysis of mathematical problem-solving abilities of students in class VII-B MTs PP Nurul Huda Lubuk Batu Jaya after the implementation of Problem Based Learning on the subject matter of social arithmetic in cycle I can be seen in the following table.

Table 3. Percentage of Students Who Get Maximum Score in Each Aspect of KPMM Cycle I

	Aspects of KPMM that are measured											
	Understanding the problem (Max Score 3)			Planning a Solution (Max Score 2)			Executing the Plan (Max Score 3)			Interpreting Results (Max Score 2)		
	Question Number			Question Number			Question Number			Question Number		
	1	2	3	1	2	3	1	2	3	1	2	3
Number of Students With Max score	24	22	11	23	9	3	22	0	0	22	0	0
Percentage (%)	100	91	45	95	38	13	91	0	0	91	0	0

In cycle I, students have begun to solve problem-solving problems based on indicators of problem-solving abilities. Through table 3. it can be seen that there are still many students who have not gotten the maximum score. Even so, the number of students who got the maximum score on the KPMM test cycle was better than the initial KPMM.

Table 4. Percentage of Students Who Get the Maximum Score in Each Aspect of KPMM Cycle II

	Aspects of KPMM that are measured											
	Understanding the problem (Max Score 3)			Planning a Solution (Max Score 2)			Executing the Plan (Max Score 3)			Interpreting Results (Max Score 2)		
	Question Number			Question Number			Question Number			Question Number		
	1	2	3	1	2	3	1	2	3	1	2	3
Number of students with max score	24	24	19	21	21	9	3	24	9	2	24	9
Percentage (%)	100	100	79	88	88	38	13	100	38	8	100	38

Table 4. shows that the percentage of students who got the maximum score in each aspect of KPMM increased from cycle I. Although some students still missed the step of interpreting the results, overall, students' mathematical problem-solving abilities were getting better than in cycle I. The analysis of students' KPMM qualifications before and after the application of the PBL model on the subject matter of comparison and social arithmetic can be seen in the following table.

Table 5. Increase in Each Frequency of Student KPMM Qualifications

Score Interval	Total Students			KPMM Qualification
	Pre-Test	Cycle I	Cycle II	
85,00 – 100	0	3	11	Very Good
70,00 – 84, 99	3	9	13	Good
55, 00 – 69,99	6	8	0	Enough
40,00 – 54,99	5	4	0	Not Enough
0 – 39,99	10	0	0	Very Less

An increase in the frequency of students' KPMM qualifications shows that with the application of the Problem Based Learning model, the KPMM of students in each qualification has increased. Until the second cycle, it can be seen that the number of students who obtained very good qualifications was 11 people and 13 people had good qualifications. There are no more students who are poor and have very poor qualifications.

Classical KPMM analysis. Based on the average KPMM score of students before and after the action, there was an increase where the average score before the action (initial score) was 39.58. The average KPMM value in the first cycle is 68.61. The average KPMM value in the second cycle is 86.36. The average KPMM of students in the first cycle was 29.03 higher than the initial value. Meanwhile, the student KPMM in the second cycle was 17.75, higher than in the first.

This discussion is carried out based on the results of observations through observation sheets of teacher and student activities in learning mathematics and analysis of students' KPMM test results through end-of-cycle test questions. Based on the results of the researcher's interview with the mathematics teacher class VII-B MTs PP Nurul Huda Lubuk Batu Jaya on the initial observation

before the action, it is known that the students' mathematical problem-solving ability is low. Researchers want to improve the mathematics learning process by applying the Problem Based Learning (PBL) model in mathematics learning. The goal is to help improve students' mathematical problem-solving abilities.

Data analysis on teacher and student activities shows an improvement in the learning process at each meeting, where the quality of implementing the Problem Based Learning model is increasingly in accordance with learning planning. Based on the observation sheet during the learning process in class VII-B Mts PP Nurul Huda Lubuk Batu Jaya, most students' participation is getting more active in every step of solving problems. However, there were several obstacles during the research, where the learning process planned in the first cycle had not been fully achieved. Students are not used to using the steps of the PBL model, so the stages carried out are not fully in accordance with the planning.

The data obtained in the first and second cycles shows students' overall mathematical problem-solving ability has increased after being given action. The average mathematical problem-solving ability test of students in the second cycle increased to 86.36 compared to the test results in the first cycle, only 68.61, and the initial mathematical problem-solving ability test results were only 39.58. In the first action cycle, the researcher emphasized to students the importance of solving problems in the problem by using the stages of problem-solving. However, some students still missed the problem-solving step in the first cycle test results. Students did not complete or even write a problem-solving plan but immediately solved the problem and interpreted the results. Then, students are less careful in performing arithmetic operations, so students make mistakes in interpreting the results. The shortcomings that occurred in the first cycle have been corrected by the researchers in the second cycle so that no more students miss the problem-solving step.

The increase in students' mathematical problem-solving abilities is due to the implementation of the Problem Based Learning model, providing opportunities for each individual to understand the subject matter and increase their contribution in group discussions. Students contribute to each other in finding their knowledge so that learning becomes meaningful and the knowledge gained lasts a long time. In addition, each group must contribute and encourage each other to have problem-solving abilities. The learning process has increased students' activity and sense of responsibility and developed their ability to work with other students. The Problem Based Learning model in this study improves students' mathematical problem-solving abilities as in previous studies that have been carried out by several researchers, including research conducted by Gd. Gunantara, who said that the application of the Problem Based Learning model increased the KPMM of fifth-grade students [16]. In line with this research, Indah Fitriani also said that the Problem Based Learning model has a very good and positive role in students' mathematical problem-solving abilities [17].

Through the analysis of the activities of teachers and students, as well as the analysis of the results of the KPMM students, it can be concluded that the hypothesis of the proposed action can be accepted as true. Thus, applying the Problem Based Learning model can improve the learning process and the mathematical problem-solving abilities of class VII-B students of MTs PP Nurul Huda Lubuk Batu Jaya on the subject matter of Social Arithmetic for the academic year 2021/2022.

CONCLUSIONS AND SUGGESTIONS

Based on data analysis and discussion, it can be concluded that: The application of the Problem Based Learning model can improve the learning process so that it can improve students' mathematical

problem-solving abilities in grade VII-B students of MTs PP Nurul Huda Lubuk Batu Jaya in the even semester of the 2021/2022 academic year on the subject matter of Social Arithmetic. Based on the conclusions and discussion of this research, the researcher suggests that teachers or researchers who want to apply the PBL model should be able to monitor students and often remind students about the importance of solving a problem by using problem-solving steps. Teachers or researchers must also guide students well during solving problems so that no more students miss the problem-solving steps.

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