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Research Article

Application of Problem-based Learning Model to Improve Students' Problem-solving Skills of Class VII-E SMP Negeri 25 Malang

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Abstract.
The purpose of this study was to improve students' mathematical problem-solving skills on the material of numbers through the problem-based learning model in class VII-E of SMP Negeri 25 Malang. Classroom action research (CAR) was applied in this study. The study was carried out on 28 students of class VII-E of SMP Negeri 25 Malang. This research was conducted in 2 cycles. Results from the first cycle of classical completeness tests of 64.29% increased to 85.71% in the second cycle. In the first cycle, the highest problem-solving aspect was obtained in the aspect of understanding the problem with a percentage of 83.93% and categorized as complete, while the lowest problem-solving aspect was obtained in the re-examining aspect with a percentage of 59.29% and categorized as incomplete. In the second cycle, the highest problem-solving aspect was obtained in the aspect of understanding the problem with a percentage of 92.86% and categorized as complete, while the lowest problem-solving aspect was obtained in the re-examining aspect with a percentage of 70.24% and categorized as incomplete. It is possible to say that students' ability to solve mathematical problems had increased in the class VII-E of SMP Negeri 25 Malang during the academic year of 2022/2023, allowing the problem-based learning model to be used as an alternative method to improve students' ability to solve mathematical problems.

Keywords: problem-based learning, Kemampuan Pemecahan Masalah, Ketuntasan Klasikal

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1. INTRODUCTION

Learning mathematics is an effort to assist students in reconstructing mathematical concepts or principles using their talents through an internalization process. The ability to solve mathematical problems is one of the mathematical skills that pupils need to possess (Utami & Wutsqa, 2017). According to the 2006 Regulation of the Minister of National Education Number 22, the ability to solve problems is one of the mathematical learning objectives that pupils must attain.

According to Jones (Budiyono, 2005), who represents the opposite opinion, there are various reasons why students need to develop their problem-solving abilities, including the ability to think conceptually and mathematically and a solid problem-solving comprehension. Additionally, the problem-solving ability is a skill or capability that students have to solve problems and use them in daily life, according to Gunantara et al. (2014).

The Trends in International Mathematics and Science Study (TIMSS) and the Program for International Student Assessment (PISA) are two international studies that gauge students' ability for problem-solving. The results of the 2015 TIMSS test, Indonesia is ranked 44th out of 49 participating countries with a score of 386. While a result of the PISA test, Indonesia placed 63rd out of 64 participating countries. For both TIMSS and PISA, the global average score is 500. The results of the two test studies demonstrate that Indonesia is below average in terms of its pupils' ability to solve mathematical problems, which is still low for a variety of reasons. One of them is a lack of experience with solving complex problems (Afriansyah, 2016). Teachers must therefore revisit students' mathematical skills for them to develop the desired level of problem-solving skills.

The development of students' ideas and problem-solving is still weak. In fact, it was also found in SMP Negeri 25 Malang which showed that students' mathematical problem-solving abilities were not in accordance with what was expected. For example, the teacher gives examples of questions and the solutions, then when the teacher gives examples of the second problem, the students cannot work on the problem because it is slightly different from the first example problem. One of the contributing factors is that students' mathematical problem-solving abilities are not applied optimally.

Figure 1 illustrates how the issue cannot be solved properly. The question asks for the difference in time used between Dio and Sasha, in which the first step is to convert mixed fractions into normal fractions and then put them in the same units as they are known. After the units are the same, then the difference can be found by taking the longest time minus the fastest time.

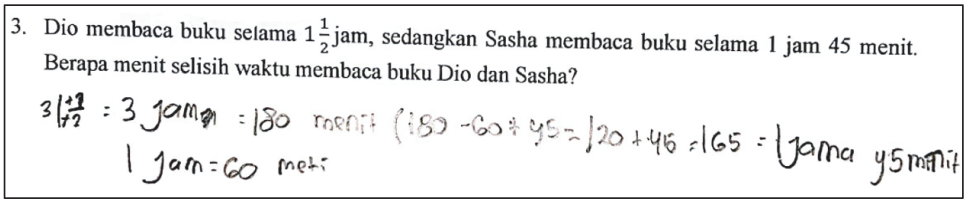

Figure 1: Student Worksheet.

Problem-based learning (PBL) is one of the instructional strategies that can help students become more competent at solving mathematical problems (Fatimah, 2012). According to Arends in Suprihatiningrum (2013), PBL is a teaching strategy in which students engage on actual concerns in order to build their own knowledge, develop higher-order thinking and inquiry abilities, and gain independence and confidence. Where this learning-model, starting with students faced with a problem then followed by a process of searching for information that is student-centered.

According to Tan (Rusman, 2013) PBL is an innovation in learning because in PBL students' thinking abilities are truly optimized through a systematic process of group or team work, so that students can empower, hone, test, and develop their thinking skills on an ongoing basis.

A problem arises when there is "a situation where a person is trying to achieve some goal and must find a way to get there" (Chi & Glaser, 1985). Problem-solving refers to people trying to achieve goals because they don't have automatic solutions. The problem has a goal, namely what the problem solver is trying to get to achieve the goal.

There are several reasons for the need for problem-solving skills, according to Sumartini (1981), including to give students fluency in developing a concept and thinking mathematically and to have a deeper understanding of the problem. Polya (Amir, 2015) offers four phases for resolving the issue, namely (1) understanding the issue, (2) planning the solution, (3) implementing the plan, and (4) reevaluating the process and solution's outcomes.

Some pupils have trouble observing and understanding mathematics during the learning process. Students lose interest in tackling these difficulties because they are less able to solve non-routine questions relating to contextual problems when working on practice questions, which makes their efforts ineffective.

In connection with the problems experienced by students in solving non-routine questions by utilizing problem-solving skills, it is necessary to apply a learning model that can improve students' mathematical problem-solving abilities. The problem in this study is how the process of applying the Problem Based Learning (PBL) model to enhance students' problem-solving abilities in numerical operations in class VII-E SMP Negeri 25 Malang.

2. METHOD

The type of research used is Classroom Action Research (CAR). In this study, researcher conducted research in collaboration with math teachers and other colleagues in order

to enhance the continuing learning process and meet learning objectives. The planned action is in the form of applying the Problem Based Learning model to the Numbers material as an effort to enhance students' mathematical problem-solving skills. This research was conducted at SMP Negeri 25 Malang, East Java. Students took a diagnostic test to evaluate their early problem-solving skills prior to the study being done. This research was carried out on August 4 – August 26, 2022 in two cycles, with each cycle contains three meetings and ending with a Cycle Test to measure the level of students' mathematical problem-solving abilities in each cycle. The subjects of this study were class VII-E students of SMP Negeri 25 Malang in the 2022/2023 academic year who took part in learning, while the object of this research was the entire process of applying the PBL model to the Numbers material. Data collection was carried out using observation, tests, and documentation techniques. Teaching modules and student activity sheets are utilized as learning aids, then the instruments used include (1) Cycle Tests, (2) Observation Sheets, and (3) Validation Sheets.

The stages of learning in each cycle refer to the flow of classroom action research according to Arikunto (2014) which is presented in Figure 2.

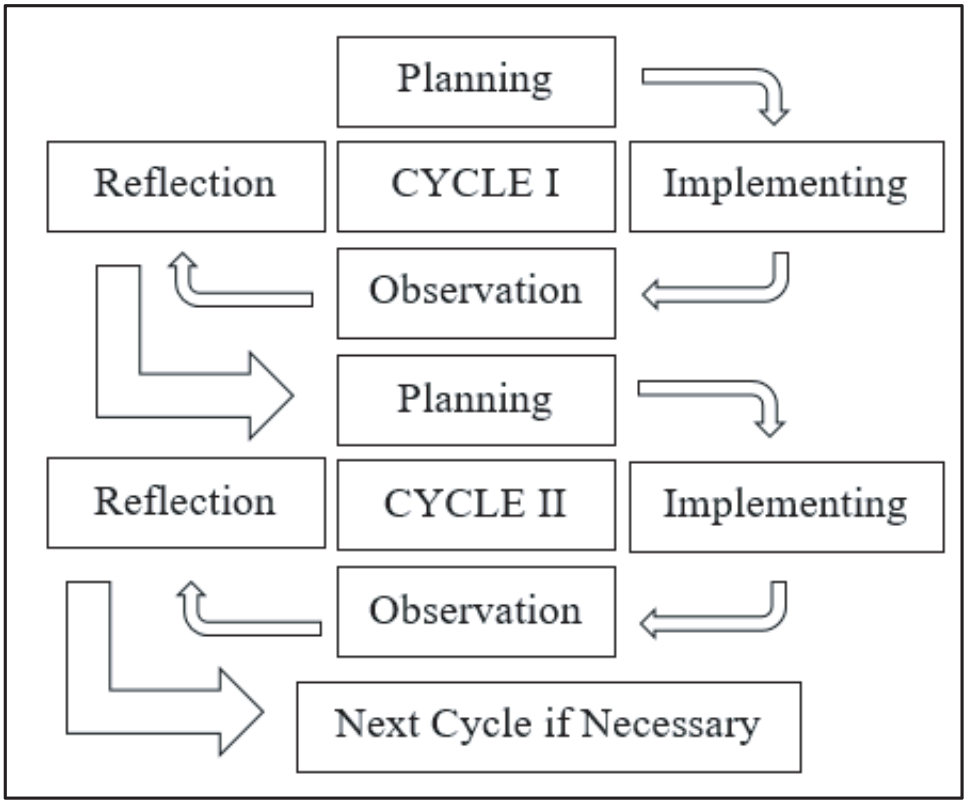

Figure 2: Model of Classrom Action Research Stages.

At the planning stage, the researcher made learning tools and research instruments. In the implementation stage, the researcher carried out learning activities in accordance

with the planned Teaching Module based on the steps of the PBL model. In the observation stage, which was carried out simultaneously with the implementation stage, the researcher was assisted by the teacher and colleagues to note things that needed to be improved in the next learning or cycle. In the reflection stage, the researcher analysed the data gathered throughout the class. The results of the reflection from the previous cycle are used to revise the plan or develop the next plan, if the actions taken have not succeeded in improving the learning process or have not succeeded in solving the problem.

The Penilaian Acuan Patokan (PAP) technique was used in this study to analyze students' ability in problem-solving. To determine the category of student completeness in problem-solving abilities, the total score of each problem-solving indicator contained in the questions and the total scores of all questions are used. The procedures are as follows: (1) Calculating the percentage of the overall score for each indicator of problem-solving ability (2) Classifying the degree of problem-solving skill and (3) Calculating the percentage of classes that have fully solved the problem. The following are the indicators of students' success in problem-solving ability: (1) based on observation results, their learning is categorized into good categories (2) the percentage of the total score on each indicator of problem-solving is at least 70%, and (3) the target achievement in one cycle is 85% of class VII-E students get a minimum score of 70. (Pratama, 2015).

3. RESULTS AND DISCUSSION

In this chapter, the results of data processing and discussion of research results were presented which are the results of a problem-solving ability test from the diagnostic test to the second cycle test on Numbers material through the Problem Based Learning model. The results of the data analysis include the percentage of each indicator of students' ability to solve mathematical problems in each action and a description of the degree of students' ability to solve mathematical problems in each action.

3.1. Students' Mathematical Problem-solving Ability

Viewed from the aspect of problem-understanding, it can be seen that there has been an increase in every action. In the diagnostic test, students' problem-understanding aspect is still low, namely 61.07%. This demonstrates that the aim for competence indicators of problem-understanding has not been met ($\geq 70\%$). Students' ability to understand problems improved to 83.93% after getting action in the first cycle and habituated

Table 1: Percentage of Each Problem-solving Indicator in Each Action.

No	Indicator of Problem-solving Test	Percentage		
		Diagnostic test	Cycle I	Cycle II
1	Problem-understanding ability	61,07%	83,93%	92,86%
2	Planning problem-solving ability	59,29%	71,43%	82,14%
3	Implementating problem-solving ability	52,32%	65,89%	72,02%
4	Re-examine completion procedure	38,21%	59,29%	70,24%

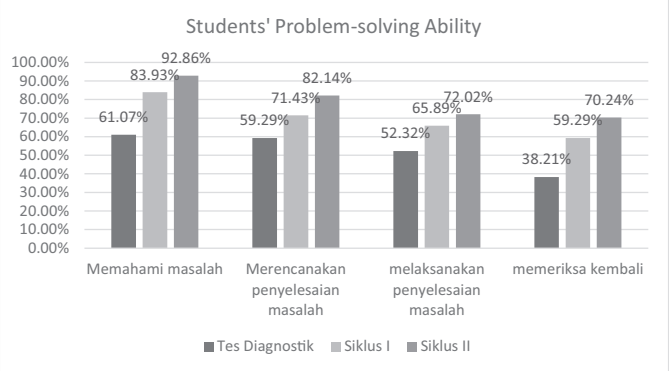

Figure 3: Graph of Each Problem-solving Indicator in Each Action.

to working in groups to solve contextual challenges in LKPD. Then the next aspect, students' ability to understand problems again increased to 92.86% in cycle II.

Viewed from the aspect of planning problem-solving, it is clear that there is an increase in every action. In the diagnostic test aspects of planning problem-solving is still low, namely 59.29%. This indicates that the target of completeness indicators for planning problem-solving has not been achieved (≥70%). The ability to comprehend students' problems improved to 71.43% when they were given the first cycle action, indicating that students' problem-solving skills in the aspects of planning problem-solving were as expected. There was an improvement of up to 82.14% once the second cycle action was carried out, which involved getting students used to solving contextual problems in LKPD in groups so that they could improve their ability to plan problem-solving.

Judging from the aspect of implementing problem-solving, it can be seen that on the diagnostic test the aspect of planning student problem solving is still very low at 52.32%. Following the first cycle action, the percentage of students who managed to solve problems rose to 65.89%. This shows that the completeness target indicator of implementing problem-solving has not been achieved (≥70%). After being given the

second cycle actions, the aspect of implementing problem-solving increased again to reach 72.02%; %, this means that students' problem-solving abilities in the aspect of planning problem solving are as expected.

As for the aspect of re-examining on the diagnostic test, a percentage of 38.21% was obtained which indicated that students' ability to re-examine and draw conclusions was still very low. Cycle I actions were carried out and the results obtained increased to 59.29% but still had not reached the completeness of the indicators for aspects of re-examining and drawing conclusions. This happened because some students considered checking again and drawing conclusions were not really important because they considered the answers they got were correct. In cycle II, the researcher instructs students that it is crucial to review and draw conclusions since it is possible that the solutions found during the problem-solving stage had an error in the calculations. After the second problem-solving ability test was carried out, it was found that the aspects of re-examining and drawing conclusions had increased to 70.24%, which means that each indicator had reached a minimum of completeness.

3.2. Classical Mastery of Students' Mathematical Problem-solving Ability

In terms of the research findings, it demonstrates that when the Problem Based Learning model is applied to Number content, students' classical completeness of problem-solving skills increases. This is based on the results of a math problem-solving test administered to students in class VII-E at SMP Negeri 25 Malang. After the implementation of learning cycle I and cycle II, there was an increase in students' ability to solve mathematical problems. In the diagnostic test, only 8 students, or 28.57% of all students, demonstrated classical mastery, however, in cycle I, this number rose to 18, or 64.29% of all students who achieve classical mastery. This indicates that an increase of 10 pupils, or 35.72 % had mastered problem-solving skills from the diagnostic test to TKPM I. In cycle II, it rose once more to 24 pupils, or 85.71% of students, who had mastered problem-solving skills. This indicates that an increase of 6 pupils, or 21.42% of students, had mastered problem-solving skills from cycle I to cycle II. Completely can be seen in table 2 and Figure 4.

Based on the description above, it can be stated that the Problem Based Learning model can improve students' problem-solving skills in the Number material for class VII-E SMP Negeri 25 Malang.

Table 2: Description of Students' Problem-solving Ability Levels in Each Action.

Mastery Percentage	Ability Level	Diagnostic Test	TKPM I	TKPM II
90% - 100%	Very high	0	0	6
80% - 89%	High	0	7	7
70% - 79%	Normal	8	11	11
60 – 69%	Low	5	4	1
0% - 59%	Very low	15	6	3
Total		28	28	28
Classical Mastery Percentage		28,57%	64,29%	85,71%
Uncomplete Percentage		71,43%	35,71%	14,29%

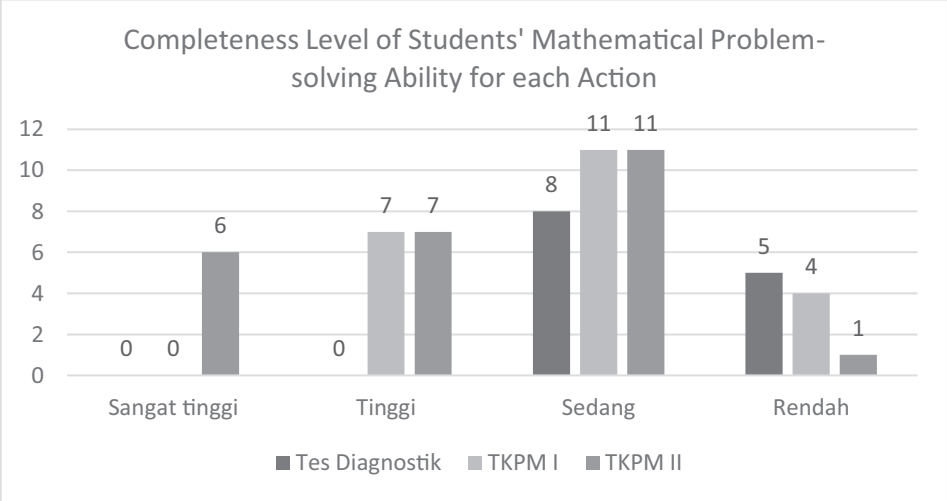

Figure 4: Completeness Level of Students' Mathematical Problem-solving Ability.

4. CONCLUSION

The application of the Problem Based Learning model succeeded in increasing problem-solving abilities in the Number material for students in class VII-E SMP Negeri 25 Malang for the 2022/2023 academic year which can be seen from the increase in test results for students' mathematical problem-solving abilities from each aspect of problem-solving from cycle I to cycle II. In cycle I, the aspect of problem-understanding received the largest percentage of 83.93%, falling into the complete category, while the aspect of re-examining received the lowest percentage of 59.29%, falling into the incomplete category. In cycle II the highest problem-solving aspect was obtained in the aspect of problem-understanding with a percentage of 92.86% and falling into the complete category, while the lowest problem-solving aspect was obtained in the re-examining aspect with a percentage of 70.24% and falling into the complete category. Apart from that, based on data analysis of students' problem-solving ability test results, it was found

that the level of students' mathematical problem-solving abilities increased from cycle I to cycle II. In cycle I, classical mastery was 64.29%, increasing to 85.71% in cycle II. That means from cycle I to cycle II there was an increase of 21.42% of students who had achieved mastery in solving problems.

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