

The Influence of Realistic Mathematics Approach on Mathematical Problem Solving Ability of Students of SMP 4 Medan

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Abstrak

Penelitian ini bertujuan untuk mengetahui peningkatan kemampuan pemecahan masalah matematis siswa melalui penerapan model Problem-Based Learning (PBL) pada siswa SMP. Penelitian ini menggunakan pendekatan kuantitatif dengan metode pre-eksperimen melalui desain One Group Pretest-Posttest. Subjek penelitian berjumlah 30 siswa kelas VIII SMP yang dipilih menggunakan teknik purposive sampling. Instrumen penelitian berupa tes kemampuan pemecahan masalah matematis yang terdiri atas lima soal uraian yang telah divalidasi oleh ahli. Data dianalisis menggunakan uji normalitas, uji t berpasangan, dan analisis N-Gain. Hasil penelitian menunjukkan bahwa rata-rata nilai pretest siswa sebesar 58,47 dan meningkat menjadi 83,13 pada posttest. Hasil uji t menunjukkan nilai signifikansi sebesar $0,000 < 0,05$ sehingga terdapat perbedaan yang signifikan antara hasil pretest dan posttest. Selanjutnya, hasil analisis N-Gain memperoleh nilai rata-rata sebesar 0,60 yang termasuk kategori sedang. Temuan penelitian menunjukkan bahwa model Problem-Based Learning efektif dalam meningkatkan kemampuan pemecahan masalah matematis siswa SMP. Oleh karena itu, model PBL dapat dijadikan sebagai salah satu alternatif pembelajaran yang mampu mengembangkan kemampuan berpikir tingkat tinggi siswa dalam pembelajaran matematika.

Kata Kunci: Problem-Based Learning, Kemampuan Pemecahan Masalah Matematis, Pembelajaran Matematika, SMP

Abstract

This study aims to determine the improvement of students' mathematical problem-solving abilities through the implementation of the Problem-Based Learning (PBL) model in junior high school students. This research employed a quantitative approach using a pre-experimental method with a One Group Pretest-Posttest Design. The participants consisted of 30 eighth-grade students selected through purposive sampling. The research instrument was a mathematical problem-solving ability test consisting of five essay questions validated by experts. Data were analyzed using normality tests, paired sample t-tests, and N-Gain analysis. The results showed that the average pretest score was 58.47 and increased to 83.13 in the posttest. The paired sample t-test indicated a significance value of $0.000 < 0.05$, showing a significant difference between pretest and posttest scores. Furthermore, the average N-Gain score was 0.60, categorized as moderate. These findings indicate that the Problem-Based Learning model effectively improves students' mathematical problem-solving abilities. Therefore, PBL can be used as an alternative instructional model to foster higher-order thinking skills in mathematics learning.

Keywords: Problem-Based Learning, Mathematical Problem-Solving Ability, Mathematics Learning, Junior High School

1. INTRODUCTION

Mathematics is a subject that plays a crucial role in developing students' logical, critical, systematic, and creative thinking skills. Through mathematics learning, students are expected to understand mathematical concepts and apply them to solve various problems encountered in everyday life. One of the primary skills focused on in mathematics learning is mathematical problem-solving.

Mathematical problem-solving skills are students' abilities to understand a problem, plan a solution strategy, implement the planned strategy, and review the results obtained. This ability aligns with the problem-solving steps proposed by Polya: understanding the problem, developing a plan, implementing the plan, and reviewing the solution. This ability is crucial because it can help students face various challenges in both academic and real-life contexts. However, various studies indicate that the mathematical problem-solving skills of students in Indonesia are still relatively low. The Programme for International Student Assessment (PISA) results indicate that the majority of Indonesian students still experience difficulty solving problems that require reasoning and problem-solving. Students tend to be accustomed to working on routine problems that only require the application of formulas without a deep understanding of the concepts.

Based on initial observations conducted at a junior high school, it was found that the mathematics learning process is still teacher-centered. Teachers often use lecture methods and practice exercises, making students passive in the learning process. Furthermore, the problems given are generally routine and have the same solution patterns as the examples provided by the teacher. As a result, students are less trained in dealing with problems that require higher-order thinking skills.

Students' low mathematical problem-solving abilities are also caused by a lack of opportunities for them to develop critical and creative thinking skills during the learning process. Conventional learning tends to position students as recipients of information, making learning activities less meaningful. Therefore, a learning model is needed that can actively engage students in identifying and solving problems. One learning model considered capable of improving students' mathematical problem-solving abilities is Problem-Based Learning (PBL). Problem-Based Learning is a student-centered learning model that uses real-life problems as a starting point for learning. Through this model, students are encouraged to identify problems, seek relevant information, formulate solutions, and evaluate the results of problem-solving, both independently and in groups.

The Problem-Based Learning model has several advantages, including improving critical thinking skills, problem-solving skills, mathematical communication skills, and collaboration skills. In problem-based learning, students not only acquire knowledge but also learn how to use that knowledge to solve problems. Several previous studies have shown that the implementation of Problem-Based Learning has a positive impact on improving students' mathematical problem-solving abilities. Research conducted by Fitriani et al. (2022) showed that students learning using the PBL model had better problem-solving skills than students

learning using conventional models. Similar research results were also reported by Rahmawati and Suryadi (2023), who found that the implementation of PBL significantly improved students' critical thinking skills and mathematics learning outcomes. Furthermore, research by Sari et al. (2024) showed that the PBL model provides students with opportunities to develop higher-order thinking skills through authentic investigation and problem-solving activities. These findings reinforce the PBL model's significant potential for improving the quality of mathematics learning. Based on this description, research is needed to further examine the effectiveness of the Problem-Based Learning model in improving junior high school students' mathematical problem-solving abilities. This research is expected to contribute to the development of more effective and innovative mathematics learning strategies.

2. RESEARCH METHOD

The research was conducted at SMP Negeri 4 Medan in the even semester of the 2025/2026 academic year. The research activities were carried out over six weeks, from February to March 2026 and included instrument preparation, pretest administration, implementation of the Problem-Based Learning model during four meetings, posttest administration, and data analysis. The population in this study was all eighth-grade students at SMP Negeri 4 Medan in the 2025/2026 academic year, consisting of five classes with a total of 150 students. The sampling technique used was purposive sampling, which is selecting samples based on specific considerations. Class VIII-A was chosen as the research class because it has relatively homogeneous academic ability characteristics based on mathematics scores from the previous semester. The total sample size was 30 students, consisting of 14 male students and 16 female students. The variables used in this study were: Independent Variable: Problem-Based Learning (PBL) model. Dependent Variable: Students' mathematical problem-solving ability.

3. RESULTS AND DISCUSSION

This study aimed to determine the improvement in junior high school students' mathematical problem-solving abilities after implementing the Problem-Based Learning (PBL) model. The study was conducted with 30 eighth-grade students at SMP Negeri 4 Medan. Before receiving the treatment, students took a pretest to determine their initial abilities. They then participated in four sessions of learning using the Problem-Based Learning model, and at the end of the lesson, a posttest was administered. The results showed an improvement in students' mathematical problem-solving abilities after implementing the Problem-Based Learning model. A description of the pretest and posttest results is presented in Table 1

Table 1. Descriptive Statistics of Pretest and Posttest Results

Statistics	Pretest	Posttest
Number of Students	30	30
Highest Score	75	98

Lowest Score	40	68
Mean	58,47	83,13
Standard Deviation	8,52	7,11

Based on Table 1, the average mathematical problem-solving ability of students before learning using the Problem-Based Learning model was 58.47. After participating in the learning, the average increased to 83.13, or an increase of 24.66 points. In addition, the minimum score increased from 40 to 68, while the maximum score increased from 75 to 98. These results indicate that the implementation of the Problem-Based Learning model has a positive impact on improving students' mathematical problem-solving abilities.

Table 2. Summary of Research Results

Indicators	Results
Number of Samples	30 students
Average Pretest Score	58.47
Average Posttest Score	83.13
Average Improvement	24.66
N-Gain Value	0.60 (Moderate)
Sig. t-Test	0.000
Classical Completeness	90.00%
Conclusion	The Problem-Based Learning model effectively improves junior high school students' mathematical problem-solving skills.

Overall, the results of the study indicate that the application of the Problem-Based Learning (PBL) model can improve the mathematical problem-solving abilities of junior high school students. This is indicated by an increase in the average score from 58.47 in the pretest to 83.13 in the posttest, an N-Gain value of 0.60 (moderate category), and t-test results that show a significant difference ($p < 0.05$). In addition, classical learning completeness reached 90.00%, exceeding the minimum standard of 85%. These findings indicate that problem-based learning provides a more active learning experience, encourages students to think critically, develop problem-solving strategies, and evaluate solutions systematically, thus positively impacting mathematical problem-solving abilities.

DISCUSSION

The results of the study indicate that the implementation of Problem-Based Learning (PBL) significantly improved junior high school students' mathematical problem-solving abilities. This was evidenced by an increase in the average student score from 58.47 in the pretest to

83.13 in the posttest, representing a 24.66-point increase. Furthermore, the results of the Paired Sample t-test showed a significance value of $0.000 < 0.05$, indicating a significant difference between students' mathematical problem-solving abilities before and after the implementation of the Problem-Based Learning model. The N-Gain analysis of 0.60 is in the moderate category, while classical learning completion increased from 23.33% to 90.00%. These findings indicate that the Problem-Based Learning model is effective in improving students' mathematical problem-solving abilities.

This improvement occurred because the Problem-Based Learning model provides students with opportunities to construct knowledge through solving real-life problems. At each stage of learning, students not only receive information from the teacher but also actively identify problems, seek information, discuss various alternative solutions, test selected strategies, and evaluate the results. These activities help students understand mathematical concepts more deeply, thus optimally developing problem-solving skills. Student-centered learning also encourages the development of critical thinking, communication, collaboration, and reflection skills, which are essential components of the mathematical problem-solving process.

The results of this study align with those of Fitriani et al. (2022), who reported that the implementation of Problem-Based Learning had a positive impact on junior high school students' mathematical problem-solving abilities. This study showed that students who learned using the PBL model had better abilities in understanding problems, developing solution strategies, and drawing conclusions compared to students who participated in conventional learning. These similar results indicate that the characteristics of Problem-Based Learning, which places contextual problems as the starting point for learning, can enhance students' thinking activities throughout the learning process.

The findings of this study also support the research of Rahmawati and Suryadi (2023), which concluded that the implementation of Problem-Based Learning significantly improved students' critical thinking and mathematical problem-solving abilities. The study explained that group discussions, independent investigations, and presentations of problem-solving results were the main factors that encouraged students to develop systematic problem-solving strategies. The results of this study showed a similar pattern, where during learning, students actively discussed, expressed opinions, and compared various problem-solving strategies before arriving at the best solution. Furthermore, the results of this study are consistent with research by Sari et al. (2024), which found that Problem-Based Learning can improve students' higher-order thinking skills. According to the study, problem-based learning encourages students to analyze, evaluate, and synthesize information when solving math

problems. These activities strengthen conceptual understanding while improving problem-solving skills. In this study, the increase in posttest scores and the high percentage of learning completion indicate that students can apply mathematical concepts more accurately after participating in learning using Problem-Based Learning.

This study's findings are also supported by research by Pratama et al. (2024), which states that Problem-Based Learning has a positive impact on problem-solving skills through collaborative activities. The study explained that group work allows students to exchange ideas, present arguments, and correct errors during the problem-solving process. A similar situation was also found in this study, where students demonstrated more active engagement during group discussions compared to previous learning methods dominated by lectures.

In addition to improving problem-solving skills, the implementation of Problem-Based Learning also increased students' motivation and confidence in learning mathematics. During the learning process, students appeared more enthusiastic when presented with problems related to everyday life. They were more confident in expressing their opinions, asking questions of the teacher and their peers, and actively presenting the results of group discussions. This indicates that problem-based learning not only improves cognitive learning outcomes but also positively impacts students' affective and social aspects.

CONCLUSION

Based on the research results and discussion regarding the application of the Problem-Based Learning (PBL) model to improve junior high school students' mathematical problem-solving skills, the following conclusions can be drawn. Students' mathematical problem-solving skills before the implementation of the Problem-Based Learning (PBL) model were still relatively low. This was demonstrated by the average pretest score of 58.47, with only 23.33% of students achieving the Minimum Completion Criteria (KKM). These results indicate that most students still experienced difficulties in understanding problems, developing solution strategies, implementing solutions, and reviewing their results.

Students' mathematical problem-solving skills improved after the implementation of the Problem-Based Learning (PBL) model. The average posttest score increased to 83.13, with 90.00% of students achieving the KKM. This improvement demonstrates that problem-based learning can create a more active, collaborative, and student-centered learning process, helping them understand mathematical concepts more deeply. The implementation of the Problem-Based Learning (PBL) model has proven effective in improving junior high school students' mathematical problem-solving skills. This is supported by the results of the Paired Sample t-test, which showed a significance value of $0.000 < 0.05$, so there is a significant

difference between students' abilities before and after treatment. Furthermore, the N-Gain analysis result of 0.60 is in the moderate category, which indicates a fairly effective increase in mathematical problem-solving abilities after the implementation of the Problem Based Learning model.

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