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Efforts To Improve Math Learning Outcomes Through Problem Solving Learning Models

Feni Trisnawati[1*], Tri Suminar[2], Eka Titi Andaryani[3]
[1,2,3] Semarang State University
fenitrisnawati@students.unnes.ac.id

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Abstract

This study aims to improve the mathematics learning outcomes of fifth-grade students through the implementation of a problem-solving learning model that emphasizes the ability to understand, analyze, and solve problems independently or in groups. The method used is Classroom Action Research (CAR), conducted in two cycles with 32 students as subjects at an elementary school in Jakarta. Data were collected through learning outcome tests, observations, and interviews. The results showed an increase in the average student score from 58.50 before the intervention to 65.00 in the first cycle and 75.50 in the second cycle, along with an increase in the percentage of students meeting the Minimum Mastery Criteria (MMC) from 43.75% to 87.50%. Additionally, there was an improvement in students' learning motivation, logical thinking skills, and collaboration. These findings indicate that the problem-solving learning model is effective in enhancing mathematics learning outcomes and is therefore recommended for continuous application by teachers in the learning process..

Keywords: learning outcomes, mathematics, learning model, problem-solving, classroom action research

Abstrak

Penelitian ini bertujuan untuk meningkatkan hasil belajar matematika siswa kelas V melalui penerapan model pembelajaran problem solving yang menekankan pada kemampuan memahami, menganalisis, dan memecahkan masalah secara mandiri maupun berkelompok. Metode yang digunakan adalah Penelitian Tindakan Kelas (PTK) yang dilaksanakan dalam dua siklus dengan subjek sebanyak 32 siswa di salah satu SD di Jakarta. Data dikumpulkan melalui tes hasil belajar, observasi, dan wawancara. Hasil penelitian menunjukkan peningkatan rata-rata nilai siswa dari 58,50 sebelum tindakan menjadi 65,00 pada siklus I dan 75,50 pada siklus II, serta peningkatan jumlah siswa yang memenuhi Kriteria Ketuntasan Minimal (KKM) dari 43,75% menjadi 87,50%. Selain itu, terdapat peningkatan motivasi belajar, kemampuan berpikir logis, dan kerja sama siswa. Temuan ini menunjukkan bahwa model pembelajaran problem solving efektif dalam meningkatkan hasil belajar matematika, sehingga disarankan untuk diterapkan secara berkelanjutan oleh guru dalam proses pembelajaran.

Kata kunci: hasil belajar, matematika, model pembelajaran, problem solving, penelitian tindakan kelas

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INTRODUCTION

Mathematics is one of the most fundamental disciplines and holds a crucial role in human life. Since early childhood, humans have applied mathematical concepts to count, measure, and organize their environment. In the context of elementary education, mathematics functions as the foundation for developing logical, systematic, and analytical thinking skills. This subject not only assists students in understanding quantitative concepts but also trains them to solve complex problems. Therefore, the teaching of mathematics at the elementary school (ES) level is highly significant (Wardhana, 2022).

The mathematics content taught in elementary schools is closely linked to students' everyday experiences. Basic concepts such as numbers, measurement, and geometry frequently appear in children's daily routines. By connecting mathematics instruction to concrete experiences, students are better able to understand and internalize the knowledge presented. Teachers must relate abstract concepts to real-life contexts to make learning more meaningful. Such strategies can enhance students' comprehension and foster greater interest in mathematics as a subject (Wardhana et al., 2021).

High-quality mathematics education is not only indicated by students' mastery of concepts but also by their ability to apply these concepts to solve real-life problems. Thus, teachers should design instruction that encourages students to think critically and creatively. It is equally important to develop higher-order thinking skills, such as analysis, evaluation, and synthesis. These goals cannot be achieved if instruction merely focuses on memorizing formulas and practicing exercises. Active student engagement in the learning process is the key to the success of mathematics education (Jumrawarsi & Suhaili, 2020).

In the long term, mastery of mathematics is highly beneficial for students' personal and professional lives. Mathematical thinking skills are required in various fields, including science, technology, and economics. Additionally, mathematics contributes to shaping students' character, such as instilling discipline, precision, and consistency in reasoning. Well-implemented mathematics instruction can encourage students to become more structured and rational individuals in facing life's challenges. Therefore, mathematics should be regarded as a strategic subject within the elementary education curriculum (Astini & Purwati, 2020).

The success of mathematics learning largely depends on the learning process that takes place in the classroom. This process encompasses the interaction between teachers, students, content, and instructional methods. One of the primary indicators of success in learning is students' academic achievement aligned with predetermined goals. When students' learning outcomes are low, it may indicate problems within the instructional process. Hence, student achievement must be thoroughly analyzed to determine the most appropriate interventions (Saputra & Marlina, 2020).

Learning outcomes are significant not only for students but also for teachers, serving as an evaluation tool to improve instruction. Teachers can assess the effectiveness of the methods employed and identify new strategies better suited to their students' characteristics. For students, learning outcomes reflect their understanding and ability to grasp the material taught. If the outcomes do not meet the Minimum Mastery Criteria (KKM), reflection and improvement in instructional strategies are required. Consequently, the learning process becomes more dynamic and adaptive (Panjaitan et al., 2020).

Although mathematics offers many benefits, the reality is that many students struggle to master it. These difficulties lead to a low interest in learning and ultimately result in unsatisfactory academic achievement. Many students perceive mathematics as a difficult and intimidating subject. This condition is further exacerbated by monotonous and less engaging teaching methods. As a result, students become less motivated to study mathematics in depth (Maufur, 2020).

The phenomenon of low mathematics achievement at the elementary school level has become a serious concern. Based on data obtained from a Mid-Semester Assessment (PTS), it was found that out of 32 students, only 14 achieved scores above the Minimum Mastery

Criteria (KKM) of 70. Meanwhile, the other 18 students scored an average of 58.5, which is below the KKM. This data indicates that the majority of students are still unable to fully understand mathematical material. Such low achievement must receive serious attention from all stakeholders, particularly teachers and educational policymakers (Pramesti & Prasetya, 2021).

One of the main factors contributing to poor learning outcomes is the use of conventional teaching approaches. Many teachers continue to rely on the lecture method as the primary strategy for teaching mathematics. In this approach, the teacher becomes the sole source of information, while students play only a passive listening role. This type of learning model does not provide students with sufficient opportunities to participate actively and to explore concepts independently. Consequently, students struggle to grasp the material comprehensively (Wibowo, 2023).

Passive learning fails to stimulate students' critical and creative thinking skills. In fact, these two abilities are crucial in understanding mathematics, which inherently requires strong logic and reasoning. When students are not encouraged to discuss, question, and attempt problem-solving themselves, they tend to rely heavily on memorization without developing deep understanding. This condition undoubtedly affects their learning outcomes. Therefore, more innovative and participatory approaches to mathematics learning are urgently needed (Darma et al., 2020).

Teachers play a vital role in creating a learning environment that is both enjoyable and intellectually challenging. Their creativity in designing lessons that actively involve students is a key determinant of learning success. One indicator of such success is the improvement of students' confidence and independence in solving problems. When students feel engaged and are given the opportunity to think critically, they become more enthusiastic and motivated to learn mathematics. Thus, the role of teachers as facilitators is highly significant in this process (Fajarudin et al., 2021).

A learning model that encourages active student participation is a promising solution to address low achievement in mathematics. One such model proven to be effective is Problem Solving, a learning approach centered on problem-based inquiry. This model allows students to think critically, creatively, and systematically in solving real-life problems. Students are guided to discover their own solutions through exploration and reflection. Consequently, their understanding of mathematical concepts becomes deeper and more meaningful (Zulmaulida et al., 2021).

In the Problem-Solving model, students actively function as problem solvers rather than mere recipients of information. They are encouraged to analyze situations, formulate problems, search for alternative solutions, and evaluate their work outcomes. This approach positions students as active and independent learners. Moreover, students also develop collaboration skills through group discussions. This aligns with the demands of 21st-century learning, which emphasizes critical thinking and problem-solving abilities (Munawwarah et al., 2020).

Problem-based learning also provides students with opportunities to connect mathematical material with real-life situations. When students perceive mathematics as relevant to their daily lives, their motivation to learn increases. The learning process becomes more enjoyable and less monotonous. Furthermore, students find it easier to recall the material since the concepts have been applied in practical contexts. This yields a positive impact on students' mathematics learning outcomes (Anggraini & Pramudita, 2021).

Despite its many advantages, the implementation of the Problem-Solving model still requires an active role from teachers. Teachers must guide students in understanding problems and determining steps for resolution. Without proper guidance, students may experience misunderstandings regarding the concepts taught. Therefore, teachers must possess strong pedagogical competence and professionalism to effectively apply this model. Maintaining a balance One of the primary strengths of this model lies in its ability to foster students' self-

confidence. By being given the freedom to solve problems according to their own styles and abilities, students feel valued and motivated. They learn to take responsibility for both their learning process and outcomes. Additionally, they benefit from learning through the mistakes made during the problem-solving process. This greatly contributes to shaping resilient student character and personality (Rosmala, 2021).

The collaborative learning process in the Problem-Solving model also offers additional benefits. Students learn to work together, listen to others' opinions, and effectively communicate their ideas. These skills are essential for developing social competencies that will be beneficial in their future lives. Moreover, peer interaction enriches their understanding of the subject matter being studied. As a result, the learning outcomes achieved are more optimal (Sukmawati & Siswono, 2021).

The Problem-Solving model also aligns well with the spirit of the Merdeka Curriculum, which emphasizes student independence and active participation in learning. This approach supports the development of the Pancasila Student Profile, which includes values such as critical reasoning, creativity, and independence. Therefore, the implementation of this model should be further expanded across various levels of education, particularly in elementary schools. Support from principals, supervisors, and educational policymakers is essential to ensure its success (Sigalingging, 2021).

Through the application of the Problem-Solving model, students are expected not only to gain knowledge but also to develop applicable thinking skills. This is crucial considering the increasingly complex and dynamic challenges of the real world. Education must not merely produce graduates capable of answering exam questions but also individuals who can think and act logically, creatively, and independently. Thus, mathematics learning should continuously be directed toward the development of such abilities (Nofriyandi et al., 2021).

Based on the explanation above, it can be concluded that the low achievement in mathematics among elementary school students is not only caused by student-related factors but also by the use of less appropriate teaching approaches. The Problem-Solving learning model emerges as a potential solution to improve the quality of mathematics learning. This model not only enhances students' learning outcomes but also fosters critical thinking and collaborative skills. With proper guidance from teachers, students are able to develop a deep and meaningful understanding of mathematical concepts. Therefore, the implementation of this model should be continuously encouraged in every mathematics learning process at the elementary level.

METHODS

The type of research employed in this study is Classroom Action Research (CAR). CAR is a problem-solving approach that utilizes concrete actions in the form of cycles through the process of detecting and resolving problems (Tampubolon, 2013). CAR focuses on issues that occur within the classroom. Accordingly, this study was conducted in the classroom and involved components of the teaching and learning process, including students, learning materials, and teaching techniques..

CAR is one of the methods used by teachers to improve and enhance the quality of education in the learning process. Its primary goal is to solve real problems that occur in the classroom. According to Dave Ebbut, as cited by (Hamzah., 2014). CAR is a systematic study aimed at improving educational practices carried out by a group of people through concrete actions and self-reflection on the consequences of those actions. Thus, CAR is a structured classroom practice designed to improve the teaching and learning process through direct actions..

Similarly, Kunandar, as cited by (Ekawarna., 2013), stated that CAR is an activity conducted by teachers, either individually or collaboratively, to improve or enhance the quality of the teaching and learning process in their classrooms. Therefore, CAR is essentially a set of actions undertaken by teachers during the teaching and learning process to enhance

the quality of instruction.

Furthermore, David Hopkins, Kemmis, and McTaggart, as cited by (Tampubolon S. M., 2013). explained that CAR is a strategy for detecting and solving educational problems through concrete actions, employing a cyclical research procedure (recycling). Through this cycle, it is expected that students can identify classroom problems and address them systematically.

Based on the above definitions, CAR can be understood as a research approach that applies direct classroom actions to improve the quality of learning and achieve better learning outcomes. It is also characterized by its cyclical nature. The implementation of CAR aims not only to enhance teaching practices in the classroom and improve students' learning outcomes but also to foster teacher creativity and innovation in instructional practices.

In this study, the research began with a preliminary stage and was planned to be conducted in two cycles. A cycle is a sequence of activities that returns to the initial step. Each cycle consists of four stages: **Planning, Acting, Observing, and Reflecting**.

More specifically, the procedure for implementing this classroom action research can be illustrated in the following research flow.

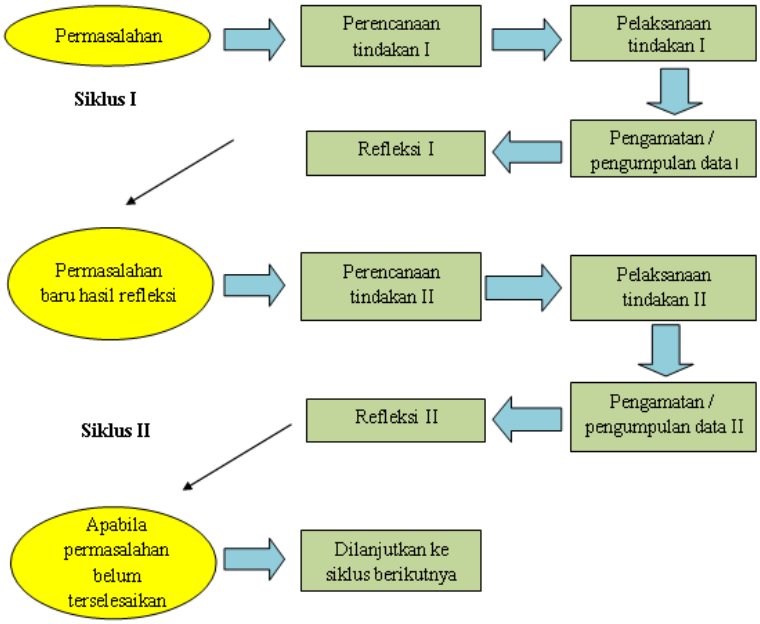

Figure 1. PTK Cycle Model Two Cycles and Beyond

(Modification of Depdiknas, 2010 and Saur, 2011) (Tampubolon S. M., Classroom Action Research, 2013)

In the learning process, teachers require a learning model to effectively and efficiently achieve the intended goals. The use of instructional materials alone is not sufficient to reach these objectives. To accomplish the desired learning outcomes, teachers need to employ an appropriate learning model. The use of a suitable learning model can foster students' motivation to learn and help them overcome the challenges they face. One such model that can enhance students' independence in learning is the **Problem-Solving model**.

It is important for teachers to fully understand the Problem-Solving model, from its definition to its implementation stages, so that they can conduct the learning process in accordance with the model and thereby optimize mathematics learning outcomes. According to (Suprijono, Cooperative Learning Teori dan Aplikasi PAIKEM), "Problem-based learning is oriented toward the ability of students to process information, referring to how individuals respond to stimuli from the environment, organize data, identify problems, develop concepts, solve problems, and use verbal and non-verbal symbols."

Students' experiences can be drawn from their environment and used as material to

acquire knowledge, which then serves as a guide and objective in their learning process. These experiences involve responding to environmental stimuli, organizing data, identifying problems, developing concepts, and solving problems (Suprijono, 2016).

Furthermore, Pepkin, as cited in (Shoimin, 2014), stated that the Problem-Solving model focuses on teaching and developing problem-solving skills accompanied by reinforcement. Thus, the Problem-Solving method is a model of instruction that not only teaches problem-solving skills but also encourages changes in students' behavior to become more critical and creative thinkers. This enables them to achieve a comprehensive understanding of the material formulated in problem contexts.

Haylock, as cited by (Siswono, 2008), explained that problem-solving can be used as an approach to assess students' creative thinking abilities. Thus, problem-solving allows students to think critically and creatively in learning mathematics.

The Problem-Solving model is an innovative learning approach that maximizes higher-order thinking, critical reasoning, and creativity in situations oriented toward real-world problems. It involves group investigations to seek information, data, solutions, and outcomes to the problems presented, often in the form of contextual story problems. Its main objective is to sharpen students' critical thinking skills while strengthening their overall understanding of the subject matter.

The population of this study consisted of all sixth-grade students at SDN Johar Baru 15, totaling 24 students. The selection criteria were based on the students' low mathematics learning outcomes, as indicated in the Mid-Semester Assessment (Penilaian Tengah Semester).

Based on the aforementioned perspectives, it can be concluded that the Problem-Solving learning model, often referred to as the problem-solving method, is an instructional approach that stimulates learners to analyze and synthesize within the structure or situation in which a problem exists, based on their own initiative. This model demands students' ability to think critically and creatively, enabling them to identify causes and consequences, and ultimately discover the key to solving the problem.

RESULTS AND DISCUSSION

The findings of this study indicate that the implementation of the problem-solving learning model significantly improved students' mathematics learning outcomes. This is evidenced by the increase in students' average scores and the growing number of students who successfully met the Minimum Mastery Criteria (KKM) from the first to the second cycle. This improvement demonstrates that the problem-solving approach provides students with more meaningful and contextual learning experiences. These findings align with The problem-solving learning model actively engages students in identifying problems, analyzing situations, and seeking appropriate and logical solutions. Thus, students are not merely memorizing formulas but are also developing a deep and applicable understanding of concepts. This is consistent with the principles of constructivist theory, which positions students as active subjects in constructing knowledge through experience and interaction (Marzuki & Suratman, n.d.). Through this model, mathematics learning becomes more dynamic as it fosters students' critical and creative thinking abilities in solving complex problems.

In the implementation of problem-solving learning, teachers provide contextual problems related to real-life situations for students to analyze collaboratively. This strategy effectively develops collaborative skills and enhances students' sense of responsibility for the learning process. Moreover, the classroom atmosphere becomes more dynamic due to active student discussions. Darwati & Purana, (2021), emphasized that group-based problem-solving learning can enhance social interaction and strengthen conceptual understanding through joint discussions and reflections.

The research data revealed an increase in students' average scores from before to after the application of the problem-solving learning model. In the first cycle, most students were still below the KKM; however, after evaluation and the refinement of strategies, the second

cycle demonstrated significant improvement. This underscores the importance of continuous evaluation and systematic improvement in the implementation of learning models. This finding is reinforced by Manik, (2020) , who showed that cyclical learning using the problem-solving approach gradually provides a positive impact on students' mathematics learning outcomes.

In addition to improvements in academic achievement, there was also a significant development in students' learning motivation. Observations during the lessons revealed that students were more enthusiastic, active, and emotionally engaged in the learning process. They felt challenged to solve the problems presented, which fostered curiosity and a greater drive to learn further. According to Kristiyani, (2020), students' intrinsic motivation increases when learning activities are challenging and provide opportunities for exploration and independent decision-making.

Beyond motivation, students' logical and analytical thinking skills also improved through the use of the problem-solving model. They gradually became accustomed to identifying patterns, exploring relationships between concepts, and formulating systematic strategies for solutions. This enhancement of thinking skills is an important indicator of the success of meaningful mathematics learning. Munasiah et al., (2020) highlighted that learning models emphasizing logical thinking processes significantly enhance students' conceptual understanding and reasoning skills.

The problem-solving model also encouraged students to be more active in group work, share ideas, and provide constructive feedback to one another. This collaborative process is crucial for developing students' social and communication skills, which are essential in everyday life. Furthermore, group discussions offered opportunities for students to consider multiple perspectives in problem-solving. Active participation in group learning also reinforced values of responsibility, tolerance, and empathy, which are integral to character education (Eko Suharyanto et al., 2021).

This model further transformed students' perceptions of mathematics from a subject often considered tedious into one that is both challenging and enjoyable. When students realized that the material studied was directly relevant to real-life situations, they became more interested and motivated to grasp the concepts taught. This underscores the importance of contextual approaches in mathematics learning so that students not only pursue grades but also achieve deep and meaningful understanding (Tamela, 2020).

Tabel 1. Average Value of Student Learning Outcomes Before and After the Application of the Problem Solving Learning Model

Cycle	Number of Students	Average Score	Students Meeting KKM (%)	Students Not Meeting KKM (%)
Before Cycle 1	32	58,50	43,75	56,25
Cycle 1	32	65,00	62,50	37,50
Cycle 2	32	75,50	87,50	12,50

(KKM Value: 70)

The implementation of the problem-solving model requires careful planning and the active role of the teacher as a facilitator who guides students' thinking processes. Teachers need to design problems that are appropriate to students' developmental levels and provide proper guidance to ensure that students remain on a constructive learning path. Thus, the teacher is no longer the sole source of information but rather a partner in the students' learning journey. This shift in the teacher's role reflects a more humanistic and participatory approach to modern education.

Overall, this study demonstrates that the problem-solving learning model has a positive impact not only on students' mathematics achievement but also on their motivation, collaboration, and thinking skills. The implementation of this model is recommended for

broader use in mathematics learning at the elementary school level, with suitable adaptations to the context and characteristics of the students. This model offers a balanced approach between conceptual mastery and character development, making it an effective choice for enhancing the quality of mathematics education in elementary schools.

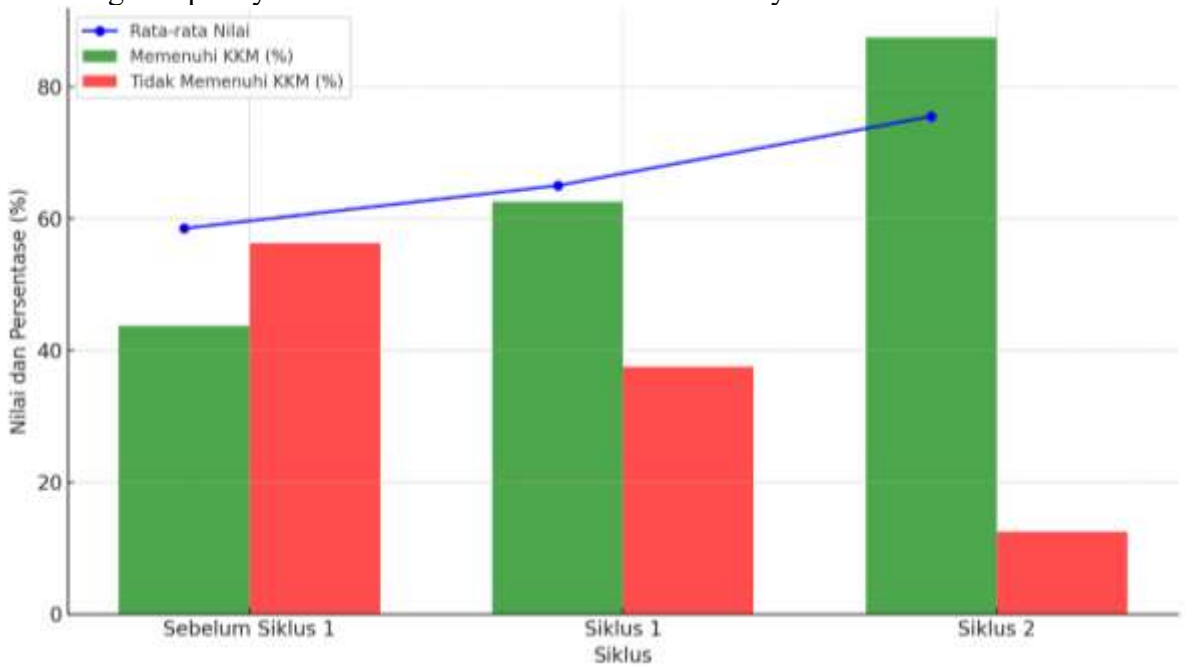

Figure 2. Comparison Diagram of Students' Learning Outcomes Before and After the Implementation of the Problem-Solving Model

The implementation of the problem-solving learning model has been proven to significantly improve students' mathematics learning outcomes. This is reflected in the data presented in Table 1, which shows an increase in the average student score from 58.50 before the intervention to 65.00 in the first cycle, and further rising to 75.50 in the second cycle. This improvement demonstrates the effectiveness of the problem-solving approach in enhancing students' conceptual understanding of mathematics while simultaneously encouraging them to think critically in solving challenging problems. The percentage of students achieving the Minimum Mastery Criteria (KKM) also rose sharply from 43.75% before the intervention to 87.50% in the second cycle, indicating the success of this strategy in helping students reach the expected learning standards.

The problem-solving model encourages students to actively analyze and find solutions to contextual problems presented during the learning process. In line with the constructivist approach, students are guided to build their own knowledge through authentic learning experiences (Taufiqurrahman & Junaidi, 2021). This learning process, which emphasizes direct student engagement, has been shown to improve the quality of interaction with both the material and the teacher, thereby accelerating the achievement of optimal learning outcomes. These findings align with Suparman dan Sari (2021), who reported that students' active involvement in problem solving strengthens conceptual mastery and enhances reasoning skills.

Beyond the cognitive aspect, the problem-solving approach also has a positive impact on students' affective and psychomotor domains. Observations during the study revealed that students demonstrated higher motivation, improved teamwork skills, and greater confidence in expressing ideas or solutions. This reinforces the view that mathematics learning should not only focus on final outcomes but also on thinking processes that involve students' social and emotional skills (Wuwung, 2020). Such improvements cannot be separated from the teacher's strategy of providing opportunities for exploration and small-group discussions, as well as delivering constructive feedback throughout the learning process.

Furthermore, the graph of learning outcomes showed a positive trend consistent with the rise in both average scores and the percentage of students achieving the KKM. This serves as visual evidence that systematic problem-based learning can facilitate the development of students' thinking skills from the initial stage through to the final intervention. The success was also supported by the teacher's role as a facilitator who guided students step by step in understanding problems, in line with the principles of scaffolding in learning (Retnodari et al., 2020). Thus, the problem-solving model contributes not only to quantitative outcomes but also enriches the overall learning process.

Overall, the findings of this study affirm the importance of employing learning models oriented toward the development of students' thinking skills and active engagement. The effectiveness of the problem-solving model in improving mathematics achievement is reinforced by previous studies, which state that this model bridges the gap between conceptual understanding and real-world problem-solving skills (Pohan, 2020). Therefore, this model can serve as a strategic alternative for teachers in designing mathematics instruction that is meaningful, interactive, and positively impactful on students' competence achievement.

KESIMPULAN DAN SARAN

Based on the findings of this study, it can be concluded that the implementation of the problem-solving learning model significantly improves students' mathematics learning outcomes. This improvement is evidenced by the increase in the average student score from 58.50 before the intervention to 75.50 in the second cycle, as well as the rise in the percentage of students meeting the Minimum Mastery Criteria (KKM) from 43.75% to 87.50%. In addition to cognitive gains, the model also positively impacts students' affective and psychomotor aspects, including learning motivation, logical thinking skills, and teamwork abilities. By actively involving students in the learning process and providing opportunities to solve problems independently, the problem-solving model has proven effective in creating more meaningful and engaging mathematics learning experiences. Therefore, this model is recommended as a viable approach to enhance the quality of mathematics instruction at the elementary school level.

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