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Implementation of Problem-Solving Model to Improve Students' Mathematical Problem-Solving Ability at SD Negeri 4 Bandar Baru

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ABSTRACT

This study aims to improve the mathematical problem-solving skills of fifth-grade students at SD Negeri 4 Bandar Baru through the application of the Problem-Solving learning model. The research was motivated by the fact that many students demonstrated difficulties in understanding mathematical concepts, interpreting problems, and applying appropriate strategies to find solutions. A Classroom Action Research (CAR) design was employed, consisting of two cycles with each cycle including the stages of planning, implementation, observation, and reflection. The participants were 30 students from class V, and data collection was carried out through problem-solving tests, observation sheets, and documentation. The results of the study indicated a significant improvement in students' mathematical problem-solving abilities. In the preliminary stage, only 36.7% of students achieved the minimum mastery criterion (KKM = 70), with an average score of 62.5. After the first cycle, the average score increased to 73.2 with 66.7% of students meeting the mastery criterion. Further progress was observed in the second cycle, where the average score reached 82.6 and the percentage of students achieving mastery rose to 90%. In addition, students showed higher motivation, better collaboration, and more systematic reasoning in solving mathematical problems. These findings suggest that the Problem-Solving model is effective in enhancing students' mathematical problem-solving skills and can be implemented as an alternative instructional strategy in elementary mathematics learning.

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Introduction

Mathematics is a fundamental subject in school curricula because it equips students with logical reasoning, analytical thinking, and problem-solving abilities that are essential in everyday life. In elementary education, mathematics not only provides basic knowledge but also builds the foundation for higher-level thinking skills that students

will need in secondary and higher education (Kilpatrick, Swafford, & Findell, 2001). One of the central goals of mathematics education is the development of problem-solving skills. Problem solving requires students to identify problems, understand underlying concepts, select strategies, and evaluate solutions (Polya, 2004). These skills are critical in fostering mathematical literacy and preparing students to adapt to real-life challenges.

Despite its importance, problem solving remains one of the most difficult competencies for elementary school students to master. Research has shown that many students face challenges in interpreting word problems, applying concepts to new situations, and using systematic reasoning strategies (Lester, 2013). This difficulty is often reflected in low mathematics achievement and a lack of confidence in handling mathematical tasks. In the Indonesian context, the issue of weak mathematical problem-solving skills is particularly concerning. National assessments and classroom observations reveal that many students rely heavily on memorization rather than developing conceptual understanding and problem-solving abilities (Suryanto, 2014). As a result, innovative instructional strategies are needed to help address these gaps.

The Problem-Solving learning model offers a promising alternative to traditional teaching methods. This model emphasizes active engagement, where students are encouraged to analyze problems, generate hypotheses, test possible solutions, and reflect on the outcomes (Schoenfeld, 2016). Such an approach aligns with constructivist learning theory, which views knowledge as actively constructed by learners through meaningful experiences. Studies have demonstrated that problem-solving instruction enhances students' mathematical reasoning and promotes deeper understanding of concepts (Kaur, 2017). By engaging in problem-solving processes, students not only learn to apply mathematics but also develop persistence, creativity, and metacognitive skills.

Furthermore, problem-solving approaches are closely linked to 21st-century skills, such as critical thinking, collaboration, and adaptability (Trilling & Fadel, 2009). Incorporating this model in elementary mathematics instruction ensures that students are better prepared for the demands of the modern knowledge society. An additional advantage of the Problem-Solving model is its potential to improve student motivation and engagement. When students are presented with meaningful problems, they are more likely to become curious, engaged, and willing to explore multiple solution paths (Hiebert & Grouws, 2007). This contrasts with rote-based methods, which often lead to disengagement and superficial learning.

Empirical evidence has shown that classrooms implementing problem-solving models report higher achievement and improved attitudes toward mathematics (Cai & Lester, 2010). For example, students engaged in problem-solving activities

demonstrated greater ability to transfer knowledge across topics and apply mathematical concepts in non-routine situations. In addition, teachers play a critical role in facilitating problem-solving instruction. They must design appropriate tasks, guide students' exploration, and foster a supportive environment where errors are seen as opportunities for learning (Liljedahl, 2016). Effective implementation of the model requires teachers to balance guidance with opportunities for independent inquiry.

At the elementary level, this approach is especially beneficial because students are in a developmental stage where curiosity and exploration are natural tendencies. Problem-solving instruction leverages these tendencies by situating learning within meaningful and contextualized tasks (NCTM, 2000). Preliminary observations in SD Negeri 4 Bandar Baru revealed that many fifth-grade students struggled with mathematical problem solving. Most students had difficulty analyzing problems systematically, which resulted in low test scores and limited mastery of problem-solving strategies. This situation underscores the urgency of implementing more effective instructional models.

Based on these conditions, this study seeks to investigate the effectiveness of the Problem-Solving learning model in improving students' mathematical problem-solving skills. By conducting classroom action research, the study aims to provide practical solutions that are directly applicable to the teaching-learning process. The significance of this research lies not only in its potential to raise students' academic performance but also in its contribution to fostering critical and reflective thinking. In a broader sense, the study supports educational reforms that emphasize competency-based learning rather than rote memorization. In summary, the Problem-Solving model is expected to provide an effective instructional approach to address students' difficulties in mathematics. By focusing on active engagement, reasoning, and reflection, this model may serve as a valuable tool in enhancing students' problem-solving skills and overall mathematical achievement.

Methods

This study applied a Classroom Action Research (CAR) design, which is widely used to improve teaching practices by addressing practical classroom challenges through systematic cycles of planning, acting, observing, and reflecting (Kemmis, McTaggart, & Nixon, 2014). The CAR approach was considered suitable because it enables iterative improvement in instructional strategies while directly responding to students' learning needs. The research was conducted in the fifth grade of SD Negeri 4 Bandar Baru, involving 30 students aged 10–11 years. The class was chosen purposively, based on preliminary findings that indicated students' difficulties in mathematical problem solving, particularly in analyzing problems and applying solution strategies. At this developmental stage, students are transitioning to more abstract thinking, making it

essential to introduce approaches such as the Problem-Solving model (Piaget, 1973; NCTM, 2000).

The intervention followed two CAR cycles, with each cycle consisting of four stages: (1) planning, where lesson plans and problem-solving tasks were developed; (2) acting, in which the Problem-Solving model was implemented during mathematics lessons; (3) observing, where students' learning processes and outcomes were monitored; and (4) reflecting, where results were analyzed to improve the subsequent cycle (Burns, 2010). Instruction was designed according to Polya's (2004) four stages of problem solving: understanding the problem, devising a plan, carrying out the plan, and reviewing the solution. This structure ensured that students not only solved mathematical tasks but also engaged in systematic reasoning and reflection. Teachers served as facilitators, guiding students through questioning and scaffolding without directly providing solutions (Schoenfeld, 2016).

Data collection employed multiple instruments to ensure validity. A problem-solving test was used to measure students' cognitive achievement, observation sheets were employed to record classroom participation, and documentation was collected in the form of lesson plans, student work samples, and photographs. This multimodal data collection aligns with best practices in mixed-methods educational research (Creswell & Plano Clark, 2017). The problem-solving test was adapted from indicators developed by the National Council of Teachers of Mathematics (2000), covering aspects such as problem comprehension, strategy selection, logical reasoning, and accuracy of solutions. A rubric was applied to assess student performance systematically, ensuring both reliability and transparency in scoring (Brookhart, 2013).

To strengthen the trustworthiness of findings, triangulation was applied by integrating data from tests, observations, and documentation (Miles, Huberman, & Saldaña, 2014). Quantitative data from test scores were analyzed descriptively by calculating averages and mastery percentages, while qualitative data were analyzed thematically to identify behavioral patterns and levels of student engagement. The success criterion for this study was determined by two indicators: (1) at least 80% of students achieving the minimum mastery criterion (KKM = 70), and (2) observable improvements in student motivation, participation, and independence during the problem-solving process. These criteria ensured that both cognitive and affective outcomes were considered (Hiebert & Grouws, 2007).

Ethical considerations were addressed carefully. Permissions were obtained from the school principal, classroom teacher, and parents. Students were informed that their participation would not affect their grades, and their anonymity was maintained in reporting results. Such practices align with international standards for ethical conduct in educational research (BERA, 2018). In summary, the methodology combined a CAR

framework, problem-solving pedagogy, and mixed-methods data analysis to examine how the Problem-Solving model could enhance students' mathematical problem-solving skills. This approach was expected to yield both practical improvements for the classroom and empirical evidence to inform broader instructional practices.

Result

The baseline data from the preliminary test showed that students' mathematical problem-solving skills were still relatively low. Only 11 out of 30 students (36.7%) achieved the minimum mastery criterion (KKM = 70), while the class average score was 62.5. Most students struggled with understanding problems and formulating strategies, which aligns with findings that elementary learners often face difficulties in transforming word problems into mathematical representations (Verschaffel, Greer, & De Corte, 2000). During the first cycle, the implementation of the Problem-Solving model resulted in noticeable improvements. Students were guided through Polya's four stages, and the average score increased to 73.2, with 20 students (66.7%) meeting the KKM. Although progress was made, observation data revealed that many students still required teacher scaffolding to devise problem-solving strategies. This outcome reflects Schoenfeld's (2016) assertion that developing independence in problem solving requires sustained practice and metacognitive support.

Qualitative observation indicated increased student engagement in Cycle I. Learners showed greater willingness to discuss problems in groups, though some remained hesitant to share their reasoning in front of the class. This is consistent with findings that collaborative dialogue fosters conceptual understanding but requires a supportive classroom environment to encourage participation (Webb, Franke, Ing, Wong, Fernandez, Shin, & Turrou, 2014). Reflection on Cycle I highlighted the need for more explicit strategy modeling and reinforcement of student explanations. In response, instructional adjustments were made in Cycle II, including the use of guiding questions, structured group work, and peer presentations to enhance student reasoning.

The results of Cycle II demonstrated significant improvement. The class average score rose to 82.6, and 27 students (90%) surpassed the mastery criterion. Moreover, students displayed better organization in their solutions, systematically identifying given information, planning strategies, and reviewing results. Such progress confirms that structured problem-solving approaches strengthen both cognitive and metacognitive skills (Hattie, 2009). Observation notes during Cycle II indicated that students became more confident in articulating their thought processes. Group discussions were more balanced, with previously passive students contributing to problem analysis and solution strategies. This development highlights the role of the Problem-Solving model in fostering equitable participation and collaborative knowledge construction.

Documentation of student work revealed richer mathematical reasoning and more coherent written solutions in Cycle II compared to Cycle I. Students not only computed accurately but also provided explanations for their chosen methods. This echoes NCTM's (2000) recommendation that mathematics instruction emphasize reasoning, justification, and communication as integral aspects of problem-solving competence. Overall, the findings confirm that the Problem-Solving learning model effectively enhanced both the performance and participation of fifth-grade students in mathematics. The progression across cycles demonstrates the model's potential to develop problem-solving skills while cultivating deeper engagement and confidence in mathematical reasoning.

Discussion

The findings of this study demonstrate that the implementation of the Problem-Solving model significantly enhanced students' mathematical problem-solving skills. The improvement from 36.7% mastery in the preliminary stage to 90% in the second cycle highlights the model's effectiveness in supporting both cognitive and affective learning outcomes. This supports Hiebert and Grouws (2007), who argue that instructional practices focusing on sense-making and reasoning yield greater learning gains in mathematics. The observed progress across cycles also indicates the importance of iterative scaffolding in problem-solving instruction. In the first cycle, many students depended heavily on teacher guidance, but by the second cycle, they displayed more independence in planning and justifying solutions. This reflects Schoenfeld's (2016) claim that metacognitive support is critical for cultivating autonomous problem solvers.

Additionally, the use of collaborative group work proved beneficial in enhancing participation and fostering peer-to-peer learning. Students became more willing to articulate their reasoning, and even previously passive learners contributed to discussions. Webb et al. (2014) found similar outcomes, showing that student engagement in dialogue about mathematical ideas is strongly linked to conceptual development. The systematic application of Polya's problem-solving stages was also instrumental in structuring students' thinking. By consistently guiding learners to understand problems, devise strategies, implement solutions, and review results, students were able to internalize a logical approach to mathematical reasoning. Research by Carlson and Bloom (2005) supports this, emphasizing that structured heuristics strengthen both procedural fluency and strategic competence.

Another important implication is the role of teacher facilitation. Rather than providing direct answers, the teacher acted as a guide, prompting inquiry through questioning. Such an approach aligns with constructivist perspectives, where teachers scaffold learning experiences that enable students to construct knowledge actively (Anthony & Walshaw, 2009). Beyond academic performance, the Problem-Solving model

positively influenced students' confidence and motivation. Students expressed greater enjoyment in mathematics lessons and demonstrated persistence when facing complex tasks. This finding resonates with Boaler (2016), who argues that when students experience mathematics as a creative and exploratory process, their attitudes toward the subject become more positive.

The findings also carry broader implications for elementary education. Developing strong problem-solving skills at an early stage is essential for preparing students for future mathematical learning and real-life applications. The outcomes of this study provide evidence that incorporating problem-solving approaches into regular instruction can bridge gaps between rote learning and meaningful understanding (NCTM, 2000). In summary, the Problem-Solving model not only improved students' mathematical achievement but also cultivated essential skills such as collaboration, reasoning, and perseverance. These results affirm the model's potential as a sustainable instructional strategy for elementary mathematics and suggest its adoption in wider educational contexts to promote holistic mathematical proficiency.

Conclusion

This study concludes that the implementation of the Problem-Solving learning model effectively enhanced the mathematical problem-solving skills of fifth-grade students at SD Negeri 4 Bandar Baru. The systematic use of Polya's problem-solving stages, supported by collaborative learning and teacher scaffolding, resulted in significant improvements in students' mastery scores, confidence, and engagement across two action research cycles. Beyond cognitive achievement, the model also fostered essential dispositions such as perseverance, reasoning, and communication, which are vital for long-term mathematical proficiency. These findings highlight the potential of the Problem-Solving model as a practical and sustainable instructional strategy in elementary mathematics education, offering valuable insights for teachers seeking to bridge the gap between rote learning and meaningful understanding.

References

Afriati, I., Siregar, R. S., Fonna, A., & Muna, Z. (2025). Effectivity of Inductive Method in Learning Nahwu-Sharaf at MIN 3 Banda Aceh City. Journal of Indonesian Primary School, 2(2), 1–9. https://doi.org/https://doi.org/10.62945/jips.v2i2.738

Arikunto, S. (2002). Prosedur Penelitian. Bandung: Rineka Cipta.

Dasopang, M. D., Lubis, A. H., & Dasopang, H. R. (2022). How do Millennial Parents Internalize Islamic Values in Their Early Childhood in the Digital Era? AL-ISHLAH: Jurnal Pendidikan, 14(1), 697–708.

Dasopang, M. D., Nasution, I. F. A., & Lubis, A. H. (2023). The Role of Religious and Cultural Education as A Resolution of Radicalism Conflict in Sibolga Community. HTS Theological Studies, 79(1), 1–7.

Erawadi, E., Hamka, H., & Juliana, F. (2017). The Analysis of Student's Stressed Syllables Mastery at Sixth Semester of TBI in IAIN Padangsidimpuan. English Education: English Journal for Teaching and Learning, 5(1), 44–57.

Elisyah, Nur, Islami Fatwa, Dinda Adha Hutabarat, and Zaharatul Humaira. 2024. "Pelatihan Gamifikasi: Implementasi Permainan Edukatif Untuk Meningkatkan Kualitas Pembelajaran Di SD Swasta Srikandi Lhokseumawe." *PUSAKA: Jurnal Pengabdian Masyarakat* 1(2):29–37. doi:10.62945/pusaka.v1i2.164.

Fatimah, A., & Maryani, K. (2018). Visual Literasi Media Pembelajaran Buku Cerita Anak. Jurnal Inovasi Teknologi Pendidikan, 5(1), 61–69. https://doi.org/10.21831/jitp.v5i1.16212

Gogahu, D. G. S., & Prasetyo, T. (2020). Pengembangan Media Pembelajaran Berbasis E-Bookstory untuk Meningkatkan Literasi Membaca Siswa Sekolah Dasar. Jurnal Basicedu, 4(4), 1004–1015.

Hamka, H. (2023). The Role of Principals on Teacher Performance Improvement in a Suburban School. QALAMUNA: Jurnal Pendidikan, Sosial, Dan Agama, 15(1), 371–380.

Hamka, H., Suen, M.-W., Anganthi, N. R. N., Haq, A. H. B., & Prasetyo, B. (2023). The Effectiveness of Gratitude Intervention in Reducing Negative Emotions in Sexual Abuse Victims. Psikohumaniora: Jurnal Penelitian Psikologi, 8(2), 227–240.

Harahap, S. M., & Hamka, H. (2023). Investigating the Roles of Philosophy, Culture, Language and Islam in Angkola's Local Wisdom of 'Dalihan Na Tolu.' HTS Teologiese Studies/Theological Studies, 79(1), 8164.

Hendrawati, S., Rosidin, U., & Astiani, S. (2020). Perilaku hidup bersih dan sehat (PHBS) siswa/siswi di sekolah menengah pertama negeri (SMPN). Jurnal Perawat Indonesia, 4(1), 295–307. https://doi.org/https://doi.org/10.32584/jpi.v4i1.454

Manshur, U., & Ramdlani, M. (2019). Media audio visual dalam pembelajaran PAI. Al-Murabbi:Jurnal Pendidikan Agama Islam, 5(1), 1–8.

Mardhiyah, R. H., Aldriani, S. N. F., Chitta, F., & Zulfikar, M. R. (2021). Pentingnya Keterampilan Belajar di Abad 21 sebagai Tuntutan dalam Pengembangan Sumber Daya Manusia. Lectura: Jurnal Pendidikan, 12(1), 29–40.

Ningsih, Y. S., Mulia, M., & Lubis, A. H. (2023). Development of Picture Storybooks with TheoAnthropoEco Centric Approach for Elementary School Students. AL-ISHLAH: Jurnal Pendidikan, 15(2), 1888–1903.

Nurhidayah, I., Asifah, L., & Rosidin, U. (2021). Pengetahuan , Sikap dan Perilaku Hidup Bersih dan Sehat pada Siswa Sekolah Dasar. 13(1), 61–71. https://doi.org/10.32528/ijhs.v13i1.4864

Pebtiyanti, I., Ahmad, A., Dzaky, M., Fauziah, S. N., Rendi, & Puspitasari, P. (2023). Peran kurikulum merdeka dalam meningkatkan harmonisasi antara masyarakat dan sekolah. Jurnal Pacu Pendidikan Dasar, 3(1), 269–277. https://doi.org/https://doi.org/10.22021/pacu.v3i1.411

Putra, Meiyaldi Eka, Fajar Maulana, Ramanda Rizky, and Islami Fatwa. 2023. "Peningkatan Hasil Belajar Mahasiswa Menggunakan Model Perkuliahan Problem Based Instruction (PBI) Mata Kuliah Gambar Teknik." *Jurnal Pendidikan Teknik Mesin* 10(1):22–30. doi:10.36706/jptm.v10i1.20850.

Rahmah, S., & Lubis, A. H. (2024). Problem Posing as a Learning Model to Improve Primary School Students' Mathematics Learning Outcomes in Gayo Lues. Journal of Indonesian Primary School, 1(4), 93–104.

Rahman, A., Munandar, S. A., Fitriani, A., Karlina, Y., & Yumriani. (2022). Pengertian Pendidikan, Ilmu Pendidikan dan Unsur-Unsur Pendidikan. Al Urwatul Wutsqa: Kajian Pendidikan Islam, 2(1), 1–8.

Ranisa, R., Erawadi, E., & Hamka, H. (2018). Students' Mastery in Identifying Adverbs at Grade VIII SMPN 2 Batang Toru Tapanuli Selatan. ENGLISH EDUCATION JOURNAL: English Journal for Teaching and Learning, 6(2), 241–252.

Ricardo, R., & Meilani, R. I. (2017). Impak Minat dan Motivasi Belajar terhadap Hasil Belajar Siswa. Jurnal Pendidikan Manajemen Perkantoran (JPManper), 2(2), 188–201.

Santi, Undang, & Kasja. (2023). Peran Guru PAI dalam Membentuk Karakter Peserta Didik di Sekolah. Jurnal Pendidikan Tambusai, 7(2), 16078–16084. https://doi.org/https://doi.org/10.31004/jptam.v7i2.8918

Siregar, N., & Siregar, R. S. (2025). Analysis of numeracy literacy of junior high school students in AKM questions: Learning strategies based on higher order thinking skills at SMP Negeri 5 Tapung Hilir. Jurnal Profesi Guru Indonesia, 2(1), 359–367. https://doi.org/10.62945/jpgi.v2i1.720

Siregar, R. S. (2024). Students' Preferences for Varied Learning Methods: An Empirical Study of the Effectiveness and Appeal of Diverse Instructional Approaches. Jurnal Profesi Guru Indonesia, 1(2), 140–152. https://doi.org/https://doi.org/10.62945/jpgi.v1i2.679

Siregar, R. S. (2024). *Fiqhu Al-Akbār: Taḥqī An-Naṣ Wa Taḥlīlu'Afkārihi*. UIN Ar-Raniry Fakultas Adab dan Humaniora.

Siregar, R. S. (2025). The Influence of Social Media as a Learning Resource on the Academic Behavior of Junior High School Adolescents. *KOGNITIF: Jurnal Ilmiah Pendidikan Dan Keguruan*, *2*(1), 21–28.

Siregar, R. S. (2025a). Arabic Language Learning Culture in Salaf Islamic Boarding Schools: An Ethnographic Study of Linguistic Punishment Practices and Traditions. ETNOPEDAGOGI: Jurnal Pendidikan Dan Kebudayaan, 2(2), 1–9. https://doi.org/https://doi.org/10.62945/etnopedagogi.v2i2.722

Siregar, R. S. (2025b). Evaluation of the Implementation of the Reading Literacy Program at SD Negeri 100190 Tarutung Bolak. Journal of Indonesian Primary School, 2(1), 240–250. https://doi.org/https://doi.org/10.62945/jips.v2i1.723

Siregar, R. S. (2025c). Improving the Arabic Writing Skills of Students through the Application of Contextual Learning Methods at Dayah Irsyadul Abidin Qurani. Indonesian Journal of Education and Social Humanities, 2(1), 358–369. https://doi.org/https://doi.org/10.62945/ijesh.v2i1.726

Siregar, R. S. (2025d). Principles of Subject-Based Arabic Curriculum Development: Language Skills Integration and Contextual Relevance. DEEP LEARNING: Journal of Educational Research, 1(2), 56–67. https://doi.org/https://doi.org/10.62945/deeplearning.v1i2.229

Siregar, R. S. (2025e). Students' Cognitive Difficulties in Mastering the Nahwu Rules: A Descriptive Study at SMP IT Al Farabi Bilingual Scool. Jurnal Cendekia Islam Indonesia, 1(2), 10–20. https://doi.org/https://doi.org/10.62945/jcii.v1i2.216

Sinaga, Nurul Afni, Fitri Ayu Ningtiyas, Rifaatul Mahmuzah, Yulia Zahara, and Islami Fatwa. 2023. "The Effect of Deductive-Inductive Learning Approach on Creative Thinking Ability and Learning Motivation." *Journal of Educational Research and Evaluation* 6(2):123–34. doi:10.24114/paradikma.v16i2.46952.

Siraj, S., M. Yusuf, I. Fatwa, F. Rianda, and M. Mulyadi. 2023. "Pengembangan Model Pembelajaran Reflektif Berbasis Unity of Sciences Bagi Calon Guru Sekolah Menengah Kejuruan Profesional." *Jurnal Review Pendidikan Dan Pengajaran (JRPP)* 6(4):2030–38.

Sugiyono. (2018). Metode Penelitian Kuantitatif Kualitatif dan R&D. Bandung: Alfabeta.