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THE EFFECT OF PBL APPLICATION ON THE ANALYTICAL ABILITY AND MATHEMATICAL PROBLEM SOLVING OF STUDENTS OF SDN 2 NGRAMBINGAN

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Abstract: *The limited analytical and math problem-solving abilities of young students. indicate the need to implement learning models that can systematically develop higher-order thinking skills. This research seeks to investigate the impact of implementing the Problem-Based Learning (PBL) model on the analytical abilities and mathematical problem-solving skills of fifth-grade students at SDN 2 Ngrambingan. This study uses a quantitative approach by applying a quasi-experimental design involving unequal control groups. The study involved 40 students organized into two separate groups, namely the experimental group and the control group, selected using a saturated sampling technique. Information was gathered using written tests designed to measure students' analytical skills and mathematical problem-solving abilities. The information was examined through Multivariate Analysis of Variance (MANOVA) after meeting the prerequisite tests of normality and homogeneity. The results indicated that the implementation of the PBL model had a significant effect on students' analytical skills ($p < 0.05$), however, it did not significantly influence the students' capabilities in solving mathematical problems. ($p > 0.05$). These findings suggest that the PBL model is effective in improving students' analytical skills in mathematics learning; however, it has not yet been sufficiently effective in enhancing students' mathematical problem-solving abilities. Therefore, continuous implementation of the PBL model, supported by more challenging problem designs, it is necessary to improve students' ability to solve mathematical problems.*
Keywords: *Analytical skills, elementary school students, mathematical problemsolving skills, mathematics learning, dan Problem Based Learning*

Abstrak: Rendahnya kemampuan analitis dan pemecahan masalah matematika siswa sekolah dasar menunjukkan perlunya penerapan model pembelajaran yang mampu mengembangkan keterampilan berpikir tingkat tinggi secara sistematis. Penelitian ini berfokus pada pemahaman tentang dampak penerapan model *Problem Based Learning* (PBL) terhadap kemampuan analitis serta keterampilan pemecahan masalah matematika siswa kelas V di SDN 2 Ngrambingan. Studi ini mengadopsi metode kuantitatif dengan kategori eksperimen tidak murni (quasi experiment) dan desain *non-equivalent control group design*. Subjek penelitian terdiri dari 40 siswa yang dibagi menjadi dua kelompok, yaitu kelompok eksperimen dan kelompok kontrol, dengan cara pengambilan sampel menggunakan teknik sampling jenuh. Alat pengumpulan data berupa tes tertulis yang dipakai untuk mengukur kemampuan analitis dan kemampuan pemecahan masalah matematika siswa. Data kemudian dianalisis menggunakan metode *Multivariate Analysis of Variance (MANOVA)* setelah memenuhi uji prasyarat normalitas dan homogenitas. Hasil penelitian menunjukkan bahwa penerapan model PBL berpengaruh secara signifikan terhadap kemampuan analitis siswa ($p < 0,05$),

namun tidak memberikan dampak yang berarti pada keterampilan siswa dalam menyelesaikan masalah matematika ($p > 0,05$). Hasil penelitian ini mengindikasikan bahwa penerapan model PBL berhasil dalam memperbaiki kemampuan analitis siswa saat belajar matematika, namun masih kurang optimal dalam meningkatkan kemampuan mereka dalam memecahkan masalah matematika. Oleh sebab itu, diperlukan penerapan model PBL secara terus-menerus serta didukung dengan desain masalah yang lebih menantang agar kemampuan pemecahan masalah matematika para siswa dapat berkembang secara maksimal.
Kata kunci: Kemampuan analitis, kemampuan pemecahan masalah matematika, pembelajaran matematika, *Problem Based Learning*, dan siswa Sekolah Dasar

INTRODUCTION

Education is a significant factor in influencing the development of students' thinking skills, especially in developing analytical skills which are the basis for understanding concepts and solving problems systematically. Education is a crucial element in enhancing the standard of human resources (Wibowo et al., 2024). The world of education continues to evolve in line with the demands of the times, emphasizing the importance of higher-order thinking skills among students. In the learning context, the selection of appropriate learning models has a significant impact on students' analytical skills. Analysis is an activity that involves several processes such as breaking down, distinguishing, and grouping elements to classify and recombine them based on specific criteria, and then discovering their meaning (Jumini, 2022). Analytical skills consist of three stages, namely students' ability to identify important elements of information, recognize relationships among these elements, and determine perspectives aligned with learning objectives. Analysis is a thinking process that not only involves memorization but also requires deep understanding and critical thinking.

Learning is closely associated with the achievement of educational objectives, where instruction is conducted in specific subjects, one being math (Wibowo et al., 2025). In mathematics learning, analytical skills are closely related to problem-solving skills. Mathematical problem-solving skills represent a form of thinking that activates the entire cognitive process to obtain appropriate solutions to a given problem. Therefore, mathematical problem-solving skills not only reflect mastery of concepts but also demonstrate students' critical thinking abilities in solving problems systematically (Nurfitriyani et al., 2025). However, in practice, elementary school students' mathematical problem-solving skills remain relatively low. Based on preliminary observations at SDN 2 Ngrambingan, many students experience difficulties in understanding word problems, particularly in identifying key information and determining appropriate steps to solve them. This condition indicates a gap between the curriculum's emphasis on higher-order thinking skills and students' actual abilities in the classroom.

To address these challenges, learning models that encourage active student participation and promote the construction of understanding through deep thinking processes are required. Active

learning aims to strengthen and facilitate student stimulation and responses during learning, making the learning process enjoyable and less monotonous (Imamah, 2021). To achieve learning outcomes aligned with instructional objectives, it is essential to select appropriate approaches or learning models, as these are critical considerations in the learning process (Sihombing et al., 2023). One such learning model is Problem-Based Learning (PBL).

The PBL (Problem-Based Learning) model is an instructional approach that focuses on students' mental activities in understanding learning concepts through problem-solving situations and the acquisition of knowledge. This model has advantages in helping students better understand learning concepts because they actively seek solutions to existing problems using their own abilities (Hidayati et al., 2025). Problem-Based Learning begins with the identification of a problem and continues with efforts to solve it. In order to find solutions to these challenges, students must broaden their knowledge. Teachers play a crucial role as facilitators by providing support and optimal learning facilities to improve the standard of the educational experience and foster a setting that aids in the academic growth of students (Muadzin, 2021).

In principle, PBL emphasizes the improvement and refinement of learning methods to strengthen conceptual understanding in real-life contexts, cultivate advanced thinking capabilities and skills for solving problems, increase student engagement, enhance decision-making skills, encourage information exploration, and foster self-confidence, responsibility, collaboration, and communication skills (Fany & Willyansah, 2025). The implementation of PBL at the elementary school level is particularly important because, at this stage, students begin to build the foundation of logical and systematic thinking. Through PBL, students not only learn formulas or procedures for solving problems but also develop skills in identifying essential information, designing problem-solving strategies, and drawing conclusions from their analyses. This aligns with the objectives of mathematics education, which emphasize analytical skills.

Although several studies have examined the effectiveness of PBL on mathematics learning outcomes, research that specifically investigates the impact of PBL on two critical thinking skills—analytical skills and mathematical problem-solving abilities—within elementary school children remains limited. Moreover, no similar studies have been conducted at SDN 2 Ngrambingan. Therefore, empirical research is needed to understand the extent to which PBL can have a positive impact on students at this school. This research area is important to explore and is expected to provide new insights into PBL-based mathematics learning.

Based on this description, the aim of this research is to evaluate the impact of implementing the PBL model on students' analytical skills and mathematical problem-solving abilities at SDN 2 Ngrambingan. The findings of this study are expected to be beneficial for teachers in selecting

appropriate learning models to improve the quality of mathematics instruction at the elementary school level.

Problem-Based Learning (PBL) focuses on issues or challenges instructional model that places students at the center of learning through the resolution of real-world problems, thereby enhancing students' active engagement in the learning process. PBL encourages students to evaluate information thoughtfully, assess details, and methodically create approaches for solving issues. The implementation of PBL has been widely studied across various educational contexts, including mathematics learning, particularly in improving students' problem-solving abilities. For example, a study by (Tudjuka, 2025) reported that the implementation of PBL had a significant effect on students' mathematical problem-solving skills within the context of the Merdeka Curriculum, utilizing a quasi-experimental framework that incorporates a Non-Equivalent Control Group Approach.

(Arta et al., 2020) stated that mathematical problem-solving skills encompass students' abilities to organize concepts and facts, connect prior knowledge, and utilize logical thinking skills to solve mathematical problems. Mathematical problem-solving in elementary education consists of several dimensions, each playing an important role in addressing mathematical problems in an organized and systematic manner. Polya identified four main stages of problemsolving: understanding the problem, devising a plan, carrying out the plan, and reviewing the solution (Mawar et al., 2025).

Several other studies have also reported findings that support the success of PBL in enhancing mathematical problem-solving skills. (Siddik et al., 2024) concluded that the implementation of the PBL model enhanced the mathematical problem-solving abilities of ninth-grade students at SMPN 27 Medan. Similarly, a study by (Silitonga & Simanjuntak, 2025) demonstrated that PBL supported by student worksheets (LKPD) improved students' mathematical problem-solving skills, further emphasizing the role of PBL in developing higherorder thinking skills through problem-solving activities.

Besides being good at solving problems, research shows that project-based learning also helps students improve their ability to think and analyze. Dian and Maryani (2025) investigated the implementation of PBL in fifth-grade science learning and found that PBL positively contributed to students' analytical abilities in understanding concepts and analyzing information within learning contexts. This finding supports the assumption that PBL is not only associated with problem-solving skills but also has the potential to enhance higher-order thinking skills, particularly analytical thinking.

According to (Latifa et al., 2023), the development of students' analytical thinking skills can be achieved by designing learning activities that aim to foster their ability to interpret

relationships, integrate multiple elements, and identify alternative solutions to conceptual problems. This perspective aligns with the findings of (Cahyanto et al., 2024), who reported that reflecting on the problem-solving process helps students evaluate the effectiveness of the strategies they use, identify alternative solutions, and plan adaptations when encountering similar problems in the future.

Other studies also show that problem-based learning helps improve mathematical thinking skills, like problem-solving. A systematic review of empirical studies concluded that the PBL model is effective in enhancing students' thinking skills and the use of math ideas in everyday situations, although its effectiveness is influenced by various contextual factors such as the teacher's role and the learning environment (Dian & Maryani, 2025).

Based on previous research findings, the Problem-Based Learning (PBL) model has been acknowledged as a successful method in improving students' higher-order thinking skills, especially mathematical problem-solving and analytical skills. However, most previous studies only examined these two skills separately or focused on only one variable, and did not consider the general aspects of learning outcomes. Research that simultaneously analyzes the effect of PBL on analytical skills and mathematical problem-solving skills in a single research framework is still limited, especially in the context of mathematics learning at the elementary school level. In addition, the characteristics of elementary school students' cognitive development, which differ from those of other education levels, require more specific empirical studies. So, this study wants to address this research gap by looking at how using the PBL model affects the analytical skills and math problem-solving abilities of students at SDN 2 Ngrambingan.

METHOD

The research method employed in this study was a quantitative approach using a quasiexperimental design. The quantitative approach was selected because this study aims to examine the effect of implementing the Impact of the Problem-Based Learning (PBL) approach on learners' critical thinking skills and their capacity to solve mathematical problems (Putra, 2021), as outlined in the research problems described in the introduction.

The approach taken in the research was a design featuring control groups that were not equivalent, which involved two existing classes without fully randomizing the participants (Andelinawati et al., 2023). One group was identified as the experimental cohort and received instruction using the ProblemBased Learning (PBL) model, while the other class served as the control group and received conventional instruction.

The research subjects were fifth-grade students at SDN 2 Ngrambingan, consisting of two classes with a total of 40 students. The method of sampling applied was saturated sampling, which indicates that every member of the population was encompassed in the research sample. The independent variable in this study was the Problem-Based Learning (PBL) instructional model,

while the dependent variables consisted of two aspects: students' analytical skills and mathematicalm problem-solving abilities (Mahyastuti & Hidayanto, 2020).

Analytical skills were measured using three indicators: the ability to break down information, identify relationships among concepts, and draw conclusions. Meanwhile, mathematical problem-solving ability was measured using four indicators: grasping the issue, creating a strategy, putting the strategy into action, and evaluating the outcome.

Table 1. Test Blueprint and Items

Item 1

No.	Indicator	Item Type	Description of the Question	Cognitive Level
1	Understanding the problem	Essay	Siti has 125 marbles. She wants to put them into small boxes, with each box containing 25 marbles. Outline the details that are understood and what inquiries are being made in the narrative.	Understanding
2	Devising a plan	Essay	Before calculating, write the method you will use to determine how many boxes Siti needs.	Applying
3	Carrying out the plan	Essay	Calculate how many boxes Siti needs if one box contains 25 marbles. Show your calculation process.	Applying
4	Reviewing the solution	Essay	After obtaining the answer, check whether your solution is correct. Explain how you verify your answer.	Applying

Item 2

No.	Indicator	Item Type	Description of the Question	Cognitive Level
1	Understanding the problem	Essay	Doni has 80 sheets of origami paper. He wants to make packages containing 10 sheets each. Write what information is known and what is being asked in this story.	Understanding
2	Devising a plan	Essay	Before calculating, write the method you will use to determine how many packages Doni can make.	Applying
3	Carrying out the plan	Essay	Calculate how many packages of origami paper Doni can make. Show your calculation process.	Applying
4	Reviewing the solution	Essay	Check whether your answer is correct. Explain how you verify your solution.	Applying

Item 3

No.	Indicator	Item Type	Description of the Question	Cognitive Level
1	Understanding the problem	Essay	A mother buys 45 oranges and wants to put them into bags. Each bag contains 9 oranges. Write what information is known and what is being asked in this story.	Understanding
2	Devising a plan	Essay	Write the method or plan to determine how many bags the mother needs.	Applying
3	Carrying out the plan	Essay	Calculate how many bags of oranges are needed. Show your calculation process.	Applying

No.	Indicator	Item Type	Description of the Question	Cognitive Level
4	Reviewing the solution	Essay	Recheck your calculation results. Explain how you verify the correctness of your answer.	Applying

Item 4

No.	Indicator	Item Type	Description of the Question	Cognitive Level
1	Understanding the problem	Essay	A class has 36 notebooks to be distributed equally to 4 groups. Write the information that is known and what is being asked in this story.	Understanding
2	Devising a plan	Essay	Write a solution plan to determine how many notebooks each group will receive.	Applying
3	Carrying out the plan	Essay	Calculate how many notebooks each group receives. Show your calculation process.	Applying
4	Reviewing the solution	Essay	Check whether your answer is correct. Explain how you verify your solution.	Applying

Item 5

No.	Indicator	Item Type	Description of the Question	Cognitive Level
1	Understanding the problem	Essay	Adit saves Rp1,000 per day for 15 days. Write what information is known and what is being asked in Adit's story.	Understanding
2	Devising a plan	Essay	Write the plan you will use to calculate Adit's total savings.	Applying
3	Carrying out the plan	Essay	Calculate the total amount of money Adit saves after 15 days. Show your calculation process.	Applying
4	Reviewing the solution	Essay	Check whether your result is correct. Explain how you verify your answer.	Applying

Items number 6, 7, 8, 9, and 10

No.	Indicator	Item Type	Description of the Question	Cognitive Level
6	Differentiating	Essay (Word Problem)	During the morning reading activity, two groups read different numbers of pages. Group A read 28 pages, while Group B read 15 pages. Explain the difference in the number of pages read by the two groups.	Analyzing
7	Organizing	Essay (Word Problem)	During a classroom duty activity, the numbers of plastic cups collected by students were as follows: Rafi collected 6 cups, Lala 4 cups, Analyzing Tino 6 cups, and Dina 3 cups. Group the students who collected the same number of cups and those who collected different numbers.	Analyzing
8	Attributing (Identifying Relationships)	Essay (Word Problem)	In a weekly saving competition, the amounts of money collected were: Mawar Group Rp45,000, Melati Group Rp30,000, and Anggrek Group Rp45,000. Explain the relationship among the savings amounts (which is the highest, the lowest, and which are the same).	Analyzing

No.	Indicator	Item Type	Description of the Question	Cognitive Level
9	Analyzing Parts	Essay (Word Problem)	In the school garden, there are four types of vegetables: spinach (18 bundles), water spinach (12 bundles), mustard greens (18 bundles), and chili (7 bundles). Analyze which vegetables have the same quantities and group them. Explain how you determined your answer.	Analyzing
10	Making Inferences	Essay (Word Problem)	During the Friday sports activity, the final scores of each team were: Red Team 32 points, Blue Team 25 points, Green Team 32 points, and Yellow Team 18 points. Draw a conclusion about the game results based on these scores. Explain your reasoning.	Analyzing

Based on the indicators presented in the table above, problem-solving ability was measured using Polya's (1973) problem-solving steps, the process includes four main steps: first, understanding what the problem is, then making a plan to solve it, next, carrying out that plan, and finally, checking to see if the solution worked and what can be learned from it. Meanwhile, analytical skills were measured based on the updated version of Bloom's Taxonomy created by Anderson and Krathwohl in 2001 at the analyzing level (C4), which includes the ability to break down information, recognize relationships among concepts, and draw conclusions. Both abilities are aligned with the Problem-Based Learning (PBL) approach, which emphasizes structured processes of analysis and problem solving.

The study used a written test as its data collection tool. This test was created based on the standards for analyzing information and solving math problems. Before using the test, it was checked to make sure it was accurate and dependable, so it could properly measure what the research needed (Farida & Musyarofah, 2021). Data analysis was conducted using the Multivariate Analysis of Variance (MANOVA) technique with the assistance of IBM SPSS Statistics software.

The MANOVA test was applied to examine differences in students' analytical skills and mathematical problem-solving abilities simultaneously based on class differences. Before performing the MANOVA test, the data were first examined to meet the assumptions of analysis, including normality testing using the Shapiro–Wilk method and homogeneity testing using Levene's Test. Hypothesis testing was conducted at a significance level of 0.05.

RESULT

This section presents the research results obtained from data analysis based on the research methods described earlier. The presentation of results begins with testing the prerequisites for analysis to ensure data feasibility, namely normality and homogeneity tests. The results of the normality test using the Shapiro–Wilk test show that all data are normally distributed ($p > 0.05$), while the results of the homogeneity test using the Levene test show that the variance between

groups is homogeneous ($p > 0.05$). Thus, the data meet the assumptions required for analysis using Multivariate Analysis of Variance (MANOVA). Next, hypothesis testing was done to find out the differences in analytical abilities and mathematical problem-solving abilities between students in classes that applied the Problem-Based Learning (PBL) model and those in classes that used conventional learning.

Subsequently, hypothesis testing was conducted using Multivariate Analysis of Variance (MANOVA) to examine differences in students' analytical skills and Solving math problems abilities between the class implementing the Problem-Based Learning approach and the class receiving traditional method instruction.

Table 2. Results of the MANOVA Test

Dependent Variable	F	Sig.	Interpretation
Analytical Skills	5.119	0.029	Significant
Mathematical Problem-Solving Skills	0.008	0.928	Notsignificant

Looking at Table 1, the analysis shows there is a big difference in how well students can think critically between the two classes ($F = 5.119$; $p = 0.029$). This means that using the Problem-Based Learning (PBL) method had a clear impact on students' ability to analyze things. However, the same analysis also shows there is little to no difference in how well students solve math problems between the class that used PBL and the one that didn't ($F = 0.008$; $p = 0.928$). This means that the PBL approach did not really affect students' math problem-solving skills in this study.

DISCUSSION

The results reveal that the use of the Problem-Based Learning (PBL) model significantly influences students' analytical abilities but does not yet demonstrate a meaningful impact on their mathematical problem-solving skills. This outcome is consistent with the characteristics of PBL, which emphasize higher-order thinking processes, particularly at the levels of analysis, synthesis, and evaluation. Within the context of modern learning, Bloom's Taxonomy was revised by Anderson and Krathwohl to introduce more dynamic cognitive dimensions that are relevant to the demands of the digital era (Saleh et al., 2025). Analytical skills are positioned at a lower cognitive level compared to complex problem-solving abilities, which require the integration of multiple cognitive processes such as logical reasoning, concept application, and strategic decision-making.

The effectiveness of PBL in enhancing analytical skills can be explained through the constructivist approach that underpins this model. According to constructivist theory, knowledge is actively constructed by learners through interaction with their environment and meaningful learning experiences. In the PBL context, students are presented with authentic problems that require them to identify issues, collect and analyze information, and connect relevant concepts before drawing

conclusions. This process directly trains students' analytical skills, as they actively engage in information processing rather than passively receiving explanations from the teacher. This finding aligns with previous studies indicating that PBL is effective in improving students' analytical and critical thinking skills through collaborative discussion and problem exploration (Mukhlisin et al., 2025).

Nevertheless, the absence of there is a big difference in mathematical problem-solving skills suggests that the development of this ability requires a more complex and sustained process. According to Polya's method for problem-solving theory, mathematical problem-solving involves several essential stages: problem-solving involves understanding the problem, making a plan, carrying out the plan, and checking the results. While PBL may effectively support the early stages, such as problem comprehension and analysis, mastery of systematic mathematical solution strategies requires extensive practice and sufficient experience with diverse types of problems. When the duration of PBL implementation is relatively short, students may not have adequate opportunities to deeply integrate problem-solving strategies.

Furthermore, from the perspective of cognitive load theory, problem-centered learning can impose a relatively high cognitive load, particularly for students who are not yet accustomed to learning methods that require independence and exploration. When students focus heavily on understanding the problem context and engaging in group discussions, their cognitive capacity to develop and apply effective mathematical problem-solving strategies may become limited. This condition may explain why improvements in analytical skills are more apparent than improvements in mathematical problem-solving skills, which require the simultaneous coordination of multiple cognitive processes.

In addition, students' readiness and the teacher's role in facilitating discussions also influence the outcomes of problem-based learning. PBL encourages students to construct their own knowledge through real-world problems and contexts that are relevant to everyday life (Risandy, 2023). This model requires students to engage in self-directed learning, collaboration, and reflection. If students are not yet familiar with this learning approach, their focus may remain on understanding the problem itself, resulting in less noticeable improvement in problem-solving outcomes. The teacher's role is therefore crucial in providing appropriate scaffolding to help students develop more structured and effective mathematical problemsolving strategies.

Overall, the findings of this study confirm that the Problem-Based Learning model is effective in enhancing students' analytical skills; however, its impact on mathematical problemsolving skills requires more time, careful planning, and more intensive implementation. These findings indicate that PBL should be applied continuously and supported by well-designed,

challenging problems and optimal teacher guidance in order to significantly improve students' mathematical problem-solving abilities.

CONCLUSION

Based on the findings from the data analysis and discussion, this study found that the application of the Problem-Based Learning (PBL) model had a major impact on the analytical abilities of fifth-grade students of SDN 2 Ngrambingan in mathematics learning. These findings indicate that student involvement in problem-based learning activities can train students' abilities in identifying important information, analyzing relationships between concepts, and developing higher-order thinking skills, especially the analytical abilities of elementary school students.

However, this study also found that the implementation of PBL did not significantly impact students' ability to solve math problems. This suggests that mathematical solving problems skills require a more sustained learning process, more intensive practice, and a greater variety and complexity of problems for students to optimally internalize problem-solving strategies. In other words, improved analytical skills do not automatically translate into improved mathematical ability to solve problems.

The meaning of this study is that elementary school teachers can use the Problem-Based Learning approach works well learning alternative to develop students' analytical the ability to mathematics. However, to improve mathematical problem-solving skills, teachers need to combine PBL with appropriate scaffolding, reinforcement of problem-solving strategies, and consistent implementation of PBL over a longer period. Theoretically, these findings reinforce the view that improving advanced thinking abilities has distinct characteristics and learning needs, thus requiring specific and targeted learning planning.

REFFERENCES

Andelinawati, L., Fatah, A., & Khaerunnisa, E. (2023). *Pengaruh Model Problem Based Learning (PBL) terhadap Kemampuan Pemecahan Masalah Matematis Siswa SMA*. 11–16.

Arta, I., Japa, I. G. N., & Sudarma, I. K. (2020). *Problem Based Learning Berbantuan Icebreaker Berpengaruh Terhadap Kemampuan Pemecahan Masalah Matematika*. *8*(2), 264–272.

Cahyanto, B., Srihayuningsih, N. L., Nikmah, S. A., Habsia, A., & Malang, U. I. (2024). *Implementasi Model Pembelajaran Problem Based Learning (PBL) Berbantuan LKPD Untuk Meningkatkan Literasi Sains Siswa*. *9*.

Dian, N., & Maryani, I. (2025). *Problem-based learning and its contribution to the analytical skills of 5 th grade students in science learning*. *02*(02), 70–82.

Fany, M. S., & Willyansah. (2025). *Problem-Based Learning (PBL) sebagai Strategi Pembelajaran Inovatif dalam Meningkatkan Hasil Belajar Kognitif Siswa pada Pembelajaran*.

Farida, & Musyarofah, A. (2021). *Validitas dan Reliabilitas dalam Analisis Butir Soal*. *I*(1), 34–44.

Hidayati, I. R., Wijayanto, Z., & Bariyah, I. Q. (2025). *Pengaruh Model Pembelajaran Problem Based Learning terhadap Kemampuan Berpikir Kritis Matematis Siswa Sekolah Dasar di Era*

Globalisasi. *9*(4), 1077–1091.

Imamah, Y. H. (2021). *Strategi Pembelajaran Aktif Dalam Meningkatkan Prestasi Belajar Bahasa Indonesia*. *7*, 175–184.

Jumini. (2022). *Model Pembelajaran Problem Based Learning Mampu Meningkatkan Kemampuan Analisis Siswa*. *5*(3), 108–112.

Latifa, E., Herlina, A., Hadiyanti, D., & Bruri, Y. (2023). Peningkatan Kemampuan Berpikir Analisis dan Hasil Belajar Siswa dengan Model PBL (Problem Based Larning) dalam Mata Pelajaran PPKn. *Jurnal Pendidikan Kewarganegaraan : Volume 13 , Nomor 01 , Mei 2023*. *13*.

Mahyastuti, I., & Hidayanto, E. (2020). *Kemampuan Berpikir Analitis Siswa dalam Memecahkan Masalah Matematis Students ' Analytical Thinking Ability in Mathematical Problems Solving*. *8*(1), 1–6.

Mawar, H. K. R., Trijoko, R., Handoyo, E., Bambang, S., & Decky, A. (2025). *Studi Literatur: Implementasi Model Problem Based Learning Untuk Meningkatkan Kemampuan Pemecahan Masalah Matematika Siswa Sekolah Dasar*. *9*(2), 220–230.

Muadzin, A. (2021). Konsepsi Peran Guru Sebagai Fasilitator dan Motivator Dalam Proses Pembelajaran Pendidikan Agama Islam. *Jurnal Pendidikan Islam*, *7*(2), 171–186. https://doi.org/https://doi.org/10.37286/ojs.v7i2.102

Mukhlisin, L., Waluyo, E., & Murcahyanto, H. (2025). *Problem-Based Learning (PBL) Sebagai Metode Pembelajaran Dalam Mengasah Komunikasi Dan Pemikiran Kritis*. *8*, 107–116.

Nurfitriyani, D., Irawati, R., & Rana Gustian Nugraha. (2025). *Pengaruh Model PBL Terhadap Kemampuan Pemecahan Masalah Matematis Siswa Pada Materi Piktogram Dan Diagram Batang*. *10*(September).

Putra, R. E. (2021). *Peningkatkan hasil belajar matematika menggunakan strategi pembelajaran berbasis masalah di sekolah dasar*. *2*, 61–70.

Risandy, L. A. (2023). *Penerapan Model Based Learning (PBL) dalam Pembelajaran Tematik Terpadu di Kelas 5 Sekolah Dasar*. *1*(4), 95–106.

Saleh, B., Sobandi, A., & Fatadona, H. (2025). *Penerapan Pendekatan Taksonomi Bloom dalam Penyelenggaraan Pelatihan Government Transformation Academy untuk Penguatan Kompetensi ASN di Era Digital*. *14*(1), 1381–1392.

Siddik, M., Asy-syifa, N., & Ginting, N. (2024). *Analisis Model PBL (Problem Based Learning) Dalam Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Di Kelas IX*. *10*, 1896–1909.

Sihombing, A. S. O., Sidabutar, R., & Manurung, S. (2023). *Pengaruh Model Problem Based Learning (PBL) terhadap Kemampuan Pemecahan Masalah Matematis Siswa pada Materi Sistem Persamaan Linier Tiga Variabel di Kelas X*. *05*(04), 14454–14469.

Silitonga, N., & Simanjuntak, S. D. (2025). *Penerapan Model Pembelajaran Problem Based Learning (PBL) Berbantuan LKPD untuk Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa Kelas VIII*. *3*(4), 1557–1564.

Tudjuka, M. A. (2025). *Pengaruh PBL Terhadap Kemampuan*. *4*(1), 54–63.

Wibowo, S., Murti, R. C., Wuryandani, W., & Purnomo, W. (2024). *Skills in Preparing Mathematics Teaching Modules and Their Correlation with Skills in Providing Learning Variations for Prospective Elementary School Teachers*. *12*(1), 119–129.

Wibowo, S., Wangid, M. N., & Firdaus, F. M. (2025). *The relevance of Vygotsky ' s constructivism learning theory with the differentiated learning primary schools*. *19*(1). https://doi.org/10.11591/edulearn.v19i1.21197