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The Effect of Problem-Based Learning Model on Learning Motivation and Problem-Solving Skills of Fourth Grade Elementary School Students

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Abstract
This study aims to examine the effect of the Problem-Based Learning (PBL) model on (1) students' learning motivation, (2) their problem-solving skills, and (3) the simultaneous influence of PBL on both variables in the context of Integrated Science and Social Studies (IPAS) for fourth-grade elementary students. A quantitative approach with a quasi-experimental design was employed, using a pretest-posttest non-equivalent control group design. The research was conducted at SDN 181/IX Berkah, involving 61 students divided into two classes: the experimental group received PBL instruction, while the control group used the STAD model. Data were collected through a learning motivation questionnaire and a problem-solving test developed based on Polya's indicators. Instrument validity was confirmed through expert judgment, and reliability testing using Cronbach's alpha yielded values of 0.82 for motivation and 0.79 for problem-solving. Data were analyzed using Kolmogorov–Smirnov for normality, Levene's test for homogeneity, independent sample t-tests to test individual effects, and MANOVA to assess the simultaneous effect of the PBL model. The results revealed that the PBL model had a significant effect on learning motivation ($p = .000$), problem-solving ability ($p = .000$), and their simultaneous improvement ($p = .000$). These findings suggest that PBL is an effective instructional approach to enhance students' cognitive and affective learning outcomes in IPAS learning

INTRODUCTION

The curriculum in Indonesian education has undergone changes and refinements in line with the advancement of time and technology. These curriculum changes aim to improve the quality of education in Indonesia (Malikah et al., 2022). The curriculum is revised based on the needs of students, educational institutions, and existing potentials to meet learning demands in response to the development of science and technology (Hartoyo & Rahmadayanti, 2022). The curriculum serves as a fundamental basis in education and as a guideline for the implementation of learning, which is designed and carried out to achieve educational goals (Jannati et al., 2023).

The current curriculum implemented in Indonesia is the *Kurikulum Merdeka*. This curriculum was developed as an improvement to the previous 2013 Curriculum (Suhartono, 2021). The *Kurikulum Merdeka* was first initiated by the Minister of Education, Culture, Research, and Technology, Nadiem Makarim. It represents a transformation in education initiated by the Indonesian government to produce an outstanding generation (Malikah et al., 2022). This curriculum introduces several changes and new programs, one of the most significant being the integration of Natural Science (*Ilmu Pengetahuan Alam* or IPA) and Social Studies (*Ilmu Pengetahuan Sosial* or IPS) into a new subject called *IPAS*, which has become a hallmark of the current curriculum development. Natural Science focuses on the study of natural phenomena, while Social Studies focuses on human beings and their

surrounding environment. This integration expands the real-world relevance of learning and fosters the development of 21st-century skills essential in today's era.

The goal of education is to provide an environment and learning processes that enable students to actively develop their potential. The aim is to assist students in cultivating spiritual and religious strength, self-control, moral character, and the intelligence required by society, communities, the nation, and the state (A. Y. Safitri, 2023). Through education, individuals can gain the knowledge, skills, and attitudes necessary to confront challenges and circumstances in life. Desired learning outcomes can be achieved when teachers are able to inspire students, so they become engaged and actively participate in the learning process. To prevent students from becoming bored, teachers must also be capable of capturing their attention and creating an enjoyable learning environment (Yuniar & Pertiwi, 2022).

Therefore, a strong educational transformation is necessary as a fundamental step in creating future generations with quality and 21st-century capabilities. Problem-solving ability is one of the essential skills that students must master, as every individual will face a variety of challenges requiring solutions in daily life (Kurniawati et al., 2019). Problem-solving skills are developed through direct experience, allowing students to build, understand, and apply the concepts they have learned. The IPAS learning process encourages students to engage in higher-order thinking, which enhances their problem-solving abilities. High learning motivation also plays a vital role in helping students solve problems encountered during IPAS learning.

Problem-Based Learning (PBL) is an instructional approach that centers on student engagement through real-world problem scenarios, encouraging learners to develop critical thinking, collaboration, and self-directed learning skills (Kwan, 2009; Ali, 2019; Al-Thani et al., 2025). Rather than receiving information passively, students in a PBL environment are actively involved in identifying problems, investigating possible solutions, and reflecting on their learning processes. This approach is grounded in constructivist theory, which posits that knowledge is best constructed through meaningful, context-based experiences. In the context of IPAS learning, PBL enables students to connect interdisciplinary content with everyday challenges, thereby fostering deeper conceptual understanding and enhancing both motivation and problem-solving abilities (Affandy et al., 2024; Yunita et al., 2025). Research shows that PBL helps students develop autonomy, responsibility for their learning, and the capacity to apply knowledge in complex situations—skills that are essential in the 21st century.

High learning motivation serves as a crucial element in determining the quality of education. When students possess strong motivation, they tend to learn more consistently, which positively impacts the overall teaching and learning process (Sarah, 2024). Motivation can be defined as the drive that arises from an attempt to create certain conditions, which in turn moves someone to act; however, if someone dislikes something, they will tend to avoid or refuse to engage with it (Uno, 2023). Learning motivation is an inner drive that compels an individual to act in order to achieve specific goals (Emda, 2018). A high level of learning motivation encourages students to enthusiastically explore knowledge, deepen their understanding, and complete tasks more effectively (Rosa, 2020). Enhancing students' learning motivation heavily depends on a thorough understanding of the influencing factors. Thus, teachers must be capable of developing adaptive teaching strategies and methods that are aligned with the students' conditions and characteristics (Hasmirati et al., 2023).

Motivation theories such as Deci and Ryan's Self-Determination Theory (2016) provide a robust framework for understanding student learning motivation. According to SDT, motivation is influenced by the fulfillment of three basic psychological needs: competence, autonomy, and relatedness (Deci & Ryan, 2016). When students feel capable, have the freedom to make choices, and experience a sense of connection within their learning environment, intrinsic motivation is fostered. This intrinsic motivation encourages students to engage actively and independently in the learning process. Furthermore, Ryan & Deci, (2017) emphasizes that motivation can only be optimized when students' basic physical and psychological needs are met, including safety and social recognition within the

school environment. These theories suggest that addressing these fundamental needs is crucial for designing effective educational strategies that sustain and enhance students' motivation over time.

Integrating these motivation theories into the learning context can help educators develop adaptive and student-centered teaching methods. Understanding that motivation is not merely a single factor but a complex interplay of internal drives and environmental conditions enables teachers to create supportive and stimulating classrooms. Such classrooms empower students by providing challenges appropriate to their skill levels, opportunities for autonomy, and positive social interactions. This theoretical foundation also supports the role of motivation in enhancing critical cognitive abilities like problem-solving, as motivated students are more likely to persist through difficulties and engage deeply with learning tasks (Blumenfeld et al., 2006; Cook & Artino, 2016). Therefore, incorporating well-established motivation theories into research and practice can significantly contribute to improving students' learning outcomes and fostering essential 21st-century skills.

Students' interests and talents in specific subjects are aspects that significantly influence learning motivation (E. Safitri & Sontani, 2016). In addition, the environment also plays a substantial role in shaping students' motivation to learn (Jasmira et al., 2022). A supportive and encouraging atmosphere, both at home and at school, greatly enhances students' motivation to learn (Halim & Rahma, 2020). Conversely, an unfavorable and less conducive environment may reduce students' interest and learning motivation (Dewi & Yuniarsih, 2019). Apart from intrinsic and environmental factors, the teaching method applied in learning activities also affects students' motivation (Julaiha et al., 2023). A teaching method that is not aligned with students' needs or fails to attract their attention can lead to decreased motivation to learn (Sappaile et al., 2023). Therefore, it is essential to design learning methods that are engaging, interactive, innovative, and actively involve students in order to foster motivation and evaluate the effectiveness of the applied learning method. Consistent evaluations enable educators to identify deficiencies and improve their teaching strategies (Salomo Leuwol et al., 2023).

Based on observations conducted by the researcher regarding the 2013 curriculum, Natural Science (IPA) and Social Studies (IPS) subjects were often integrated with other subjects. The same integration is also applied in the current *Kurikulum Merdeka*, where IPA and IPS are once again combined. This integration provides benefits in developing students' thinking abilities and broadening their perspectives. Consequently, a strategic learning model is needed to shift students' mindsets and expand their insight so they are capable of solving problems in their surroundings.

According to observations conducted with the teachers of Class IV A and Class IV B at SDN 181/IX Berkah, students have not yet demonstrated active engagement in the IPAS learning process. The learning process is still predominantly teacher-centered. This is evident during the lesson, in which the teacher often relies on lectures and dictation without providing sufficient opportunities for students to be actively involved. As a result, the learning environment does not adequately support the development of students' motivation to learn. In addition, students' problem-solving abilities remain low. This is due to the teaching methods that do not actively involve students or connect learning materials with real-life issues relevant to the students' daily lives. Due to the dominance of the teacher and the limited opportunities for student participation, many students appear uninterested and reluctant to engage in class. For instance, some students choose to play rather than complete assignments or homework.

Several previous studies have demonstrated the effectiveness of the Problem-Based Learning (PBL) model in improving students' academic outcomes and critical thinking skills. For instance, Elita et al. (2019) found that PBL significantly enhances students' critical and problem-solving abilities at the junior high school level. Similarly, Indriana and Maryati (2021) reported that the PBL model positively influences student engagement and learning motivation. However, most of these studies have been conducted in secondary or higher education contexts. Research focusing specifically on the simultaneous impact of PBL on learning motivation and problem-solving abilities at the elementary level, particularly within the IPAS (Integrated Natural and Social Sciences) subject, remains limited.

Therefore, the novelty of this study lies in its focus on examining the simultaneous influence of the Problem-Based Learning model on both learning motivation and problem-solving skills among elementary school students in the context of IPAS instruction. This research contributes new insights by addressing the interrelation between these two essential aspects—motivation and problem-solving—which are critical for fostering 21st-century competencies in young learners. The study also responds to the need for more empirical evidence on the application of PBL in primary education settings in Indonesia.

Moreover, findings from teacher observations indicate that teachers have not fully implemented the instructional models stated in their lesson plans. For example, the STAD model prepared for the lesson was not applied as planned. Interviews with the teachers also revealed that various instructional models—such as the inquiry model, STAD, discovery learning, project-based learning, and Problem Based Learning (PBL)—have not been optimally utilized, especially problem-based models. In practice, teachers face challenges in presenting problems as learning stimuli, facilitating investigations, and evaluating the learning outcomes. Furthermore, teachers have yet to effectively guide students toward finding solutions to the problems presented in class.

Problem-solving skills are crucial in IPAS learning, as students are expected to address real-world problems. Problem-solving involves integrating existing knowledge with students' abilities, techniques, and concepts to resolve issues (Sumarni et al., 2021). A structured and critical approach to problem-solving is found in Polya's four-stage model (Yayuk & Husamah, 2020), which includes: (1) understanding the problem, (2) devising a solution strategy, (3) executing the strategy, and (4) performing reflective actions.

One strategy to optimize students' motivation and problem-solving abilities in IPAS is through the application of an appropriate learning model (Indriana & Maryati, 2021). Learning motivation and problem-solving skills are closely interconnected aspects of the learning process. Motivation acts as a critical driver that encourages individuals to actively and effectively engage in problem-solving strategies. Motivated students are more persistent in facing challenges and more creative in generating solutions. Furthermore, high motivation enhances students' cognitive engagement and attention, which in turn strengthens their critical thinking and problem-solving abilities. Therefore, enhancing students' learning motivation through appropriate instructional models such as Problem-Based Learning (PBL) is expected to improve their capacity to solve real-world problems.

Problem-Based Learning (PBL) is an educational approach that can enhance both motivation and students' problem-solving skills. Students engaging in PBL are required to practice critical thinking to solve problems while gaining a deeper understanding of concepts and theories discussed in class (Elita et al., 2019). The objective of the PBL model is to enable students to construct their own knowledge, develop higher-order thinking skills, and foster independence and confidence through solving real-world problems (Mayasari et al., 2022). The use of the PBL model also helps students gain comprehensive knowledge, effective problem-solving techniques, independent and collaborative learning skills, and motivation to learn (Zainal, 2022).

The primary objective of this study is to examine the influence of the Problem-Based Learning (PBL) model on students' motivation to learn and their problem-solving abilities in the context of IPAS (Integrated Natural and Social Sciences) learning for fourth-grade elementary students. Specifically, this research seeks to explore how the implementation of the PBL model can enhance students' intrinsic motivation and encourage active engagement in the learning process. Additionally, the study aims to investigate how the model supports the development of students' critical thinking and analytical skills necessary for solving real-life problems. By analyzing these two aspects both independently and simultaneously, this research is intended to provide empirical evidence regarding the effectiveness of Problem-Based Learning as an instructional strategy in fostering 21st-century competencies among elementary school students.

METHODS

This study employed a quantitative approach with a quasi-experimental research design. According to Sugiyono (2022), quasi-experiment research is a type of study where the researcher cannot control external variables that may influence the implementation of the experiment. The main objective of this study was to observe the effect of a treatment by comparing one or more groups receiving different treatments. The research was conducted by comparing an experimental group that received a specific treatment with a control group that did not receive that treatment.

The research design used was a pretest-posttest non-equivalent control group design, involving two groups: the experimental group and the control group. Group assignment was conducted randomly following the procedures described by Borg (2014). The experimental group received the Problem Based Learning model treatment, while the control group was taught using either the expository or STAD model. The research stages consisted of administering a pretest to both groups, providing the treatment, and then conducting a posttest.

This study was conducted at SD Negeri 181/IX Berkah, located in Sungai Bahar District, Muaro Jambi Regency, Jambi Province. The population consisted of all fourth-grade students at SD Negeri 181/IX Berkah, totaling 61 students divided into two classes: 31 students in class IV A and 30 students in class IV B. Due to the relatively small population size, the researcher applied total sampling or census sampling, where the entire population served as the sample (Sugiyono, 2019).

Data collection was carried out using three techniques: questionnaires, tests, and documentation. The questionnaire was used to measure students' learning motivation during the learning process. The questionnaire was of a closed type, and motivation data were also supported by observations of students' behaviors and activities, as well as documentation of students' work reflecting motivation aspects such as commitment, initiative, drive, and optimism in learning. To measure problem-solving ability, written tests were used, including pretests and posttests. The test questions were developed based on Polya's indicators of problem-solving ability, which consist of understanding the problem, devising a strategy, implementing the strategy, and reflecting on the solution.

To ensure the validity of the research instruments, a content validation process was carried out before data collection. The questionnaire items on learning motivation and the test items on problem-solving ability were reviewed by two educational experts and one experienced elementary school teacher. Their feedback was used to revise item wording, improve clarity, and ensure alignment with the constructs being measured. The validation process was focused on content relevance, item clarity, and suitability for the age and cognitive development level of the students.

In addition to content validation, the reliability of the instruments was tested through a pilot study involving 30 fourth-grade students from a different school with similar characteristics. The reliability of the learning motivation questionnaire was measured using Cronbach's alpha, yielding a coefficient of 0.82, while the problem-solving ability test achieved a reliability coefficient of 0.79. These values indicate that both instruments have good internal consistency and are reliable for assessing students' learning motivation and problem-solving abilities in the IPAS subject.

Data analysis was conducted in two stages. First, descriptive analysis was used to present an overview of students' learning motivation and problem-solving ability data by reporting the mean, standard deviation, minimum, and maximum scores in tables to facilitate data interpretation. Second, inferential analysis began with normality testing using the Kolmogorov-Smirnov test with SPSS 25 for Windows at a significance level of 0.05 to ensure the data were normally distributed. This was followed by homogeneity testing to assess whether the variance between the experimental and control groups was equal. For testing hypotheses partially, an independent sample t-test was conducted, with significance determined if p-value < 0.05, indicating a significant influence of the independent variable on the dependent variable. Additionally, a MANOVA test was performed to analyze the simultaneous effect of the treatment on both learning motivation and problem-solving ability, provided that the data met the normality and homogeneity assumptions.

RESULTS AND DISCUSSION

This study was conducted at SDN 181/IX Berkah in classes IV A and IV B. The aim of the study was to assess the impact of the Problem Based Learning (PBL) model on the learning motivation and problem-solving ability of fourth-grade students in IPAS, focusing on the cultural wealth of Indonesia. The researcher conducted an initial trial of the instruments before starting the research activities. After receiving confirmation of the instrument's validity from experts, the trial was carried out. The next step involved conducting the instrument trial. Upon completion, the results were then evaluated for validity. The validity test was conducted at a school within the same cluster as the research site, involving 28 students. An instrument was considered valid if the calculated r-value (r_hitung) exceeded the critical r-value (r_tabel) at the 5% significance level. Conversely, if r_hitung was less than r_tabel, the instrument was considered invalid.

The next step was to administer a pretest to the research classes to determine students' initial levels of learning motivation and problem-solving ability before treatment was given. After the pretest, the treatment consisted of applying the PBL model in the IPAS learning process on the topic of Indonesia's cultural wealth, while the control group used the STAD model during IPAS learning on the same topic. The final step was to administer a posttest to the research classes.

The learning materials and research instruments used were prepared in advance to measure students' learning motivation and problem-solving abilities in IPAS on the topic of Indonesia's cultural wealth. The learning materials consisted of teaching modules, while the instruments included a learning motivation questionnaire and a problem-solving essay test. The Kolmogorov-Smirnov test was employed because the sample size was 61 students. If the data met the normality criterion, i.e., the significance value (Sig) was greater than 0.05, then the data were considered normally distributed. The following table presents the normality test results:

Table 1. Normality Test Results

Variable	Class		Condition	Kolmogorov-Smirnov	Criteria
Learning Motivation	Control	Pretest	0.173	Sig > 0.05	Normal
		Posttest	0.200	Sig > 0.05	Normal
	Experiment	Pretest	0.065	Sig > 0.05	Normal
		Posttest	0.200	Sig > 0.05	Normal
Problem-Solving Ability	Control	Pretest	0.200	Sig > 0.05	Normal
		Posttest	0.093	Sig > 0.05	Normal
	Experiment	Pretest	0.081	Sig > 0.05	Normal
		Posttest	0.200	Sig > 0.05	Normal

The data in Table 1 indicate that the learning motivation scores for the control group in the pretest and posttest were 0.173 and 0.200, respectively. The pretest and posttest scores for the experimental group were 0.065 and 0.200. For problem-solving ability, the control group scored 0.200 in the pretest and 0.093 in the posttest. Meanwhile, the experimental group obtained scores of 0.081 in the pretest and 0.200 in the posttest. These findings suggest that all data are normally distributed, as the Sig. values are greater than 0.05. This result provides a strong foundation to proceed with parametric statistical analysis and ensures that the collected data meet the criteria for further analysis, thereby increasing the validity and reliability of the research findings.

The homogeneity test used in this study was Levene's test. In Levene's test, the data are considered to have homogeneous variance if the significance value is greater than 0.05. The purpose of the homogeneity test is to determine whether the variances between groups in a study are similar or not. The results of the homogeneity test are presented in table 2.

Table 2. Homogeneity Test

Variable	Sig.
Learning motivation (experimental and control classes)	0.571
Problem-solving ability (experimental and control classes)	0.273

Table 2 shows that the significance value (Sig.) for learning motivation between the experimental and control classes is 0.571. In addition, the significance value for problem-solving ability between the experimental and control classes is 0.273. Since both Sig. values are greater than 0.05, the results indicate homogeneous variance. Based on the homogeneity test, it can be concluded that the variances are uniform. In further statistical analysis, this homogeneity of variance has important implications, especially when applying parametric tests such as the independent sample t-test, which will be used in the next step.

The independent sample t-test in this study was used to determine whether there was a significant difference in the average scores of learning motivation and problem-solving ability during the pretest and posttest activities. The basis for decision-making in the independent sample t-test is that if the Sig. value is less than 0.05, then H0 is rejected and Ha is accepted. The independent sample t-test was used to test the following hypotheses:

Hypothesis 1

H0: The use of the PBL model has no effect on students' learning motivation in the IPAS learning process.

Ha: The use of the PBL model affects students' learning motivation in the IPAS learning process.

Hypothesis 2

H0: The use of the PBL model has no effect on students' problem-solving ability in the IPAS learning process.

Ha: The use of the PBL model affects students' problem-solving ability in the IPAS learning process.

The results of the independent sample t-test are presented in table 3.

Table 3. Independent Sample T-Test

Variable	Group	Mean	Sig. (2-tailed)
Learning Motivation	Experimental	86.97	.000
	Control	79.00	
Problem-Solving Ability	Experimental	86.42	.000
	Control	76.87	

Table 3 presents data regarding the differences in students' learning motivation and problem-solving ability between the experimental and control groups. For the variable of learning motivation, the mean score in the experimental group was 86.97, while the control group had a mean score of 79.00. The results of the independent sample t-test show a significance value of .000 for the learning motivation variable, indicating that in Hypothesis 1, H0 is rejected and Ha is accepted. This result demonstrates that there is a significant difference in the average learning motivation scores between the experimental and control groups.

For the problem-solving ability variable, the mean score of the experimental group was 86.42, and the mean score of the control group was 76.87. The independent sample t-test yielded a significance value of .000 for the problem-solving ability variable, meaning that in Hypothesis 2, H0 is rejected and Ha is accepted. This result indicates that there is a significant difference in the average problem-solving ability scores between the experimental and control groups.

Therefore, the results of the hypothesis testing in this study confirm that the use of the Problem-Based Learning (PBL) model has an effect on students' learning motivation and problem-solving ability in the Integrated Science and Social Studies (IPAS) learning process.

MANOVA testing was conducted to determine whether the PBL learning model had a simultaneous effect on students' learning motivation and problem-solving ability in the IPAS (Integrated Science and Social Studies) learning process. The following is the hypothesis formulation for the MANOVA test:

Hypothesis 3:

H0: The use of the PBL model does not have a simultaneous effect on learning motivation and problem-solving ability of fourth-grade elementary school students.

Ha: The use of the PBL model has a simultaneous effect on learning motivation and problem-solving ability of fourth-grade elementary school students.

The criteria for accepting or rejecting H0 at a significance level of 0.05 are as follows: if the p-value (Sig.) > 0.05, then H0 is accepted; if the p-value (Sig.) < 0.05, then H0 is rejected. The findings from the MANOVA hypothesis testing are presented in the following table:

Table 4. MANOVA Test

Effect		Value	F	Hypothesis	Error	Sig.
Intercept	Pillai's Trace	.999	27932.204b	2.000	58.000	.000
	Wilks' Lambda	.001	27932.204b	2.000	58.000	.000
	Hotelling's Trace	963.179	27932.204b	2.000	58.000	.000
	Roy's Largest Root	963.179	27932.204b	2.000	58.000	.000
X	Pillai's Trace	.688	63.945b	2.000	58.000	.000
	Wilks' Lambda	.312	63.945b	2.000	58.000	.000
	Hotelling's Trace	2.205	63.945b	2.000	58.000	.000
	Roy's Largest Root	2.205	63.945b	2.000	58.000	.000

Based on Table 4, it can be observed that the p-value (Sig.) for Hotelling's Trace is 0.000. Since this value is less than 0.05, H0 is rejected and Ha is accepted. This means that the use of the Problem-Based Learning model has a significant simultaneous effect on students' learning motivation and problem-solving ability in fourth-grade Integrated Science and Social Studies (IPAS) learning.

The ability to solve problems during IPAS learning is one of the key competencies targeted in this study, and the results show that the implementation of the PBL learning model leads to a significant difference in student outcomes. Students who were taught using the PBL model demonstrated notably higher levels of motivation and problem-solving skills compared to those in the control group, as indicated by the results of the independent t-test (Sig. = 0.000). These findings reinforce the claim that PBL supports student-centered learning, engages learners through real-world connections, and offers meaningful academic experiences particularly suitable for fourth-grade elementary students. This conclusion aligns with the idea that learning environments that are relevant, interactive, and challenging tend to increase student engagement and outcomes. Therefore, the implications of this research are critical for instructional development in elementary schools. Educators and policymakers are encouraged to consider these results and adopt the PBL model as an effective strategy to enhance learning quality in IPAS classrooms. This recommendation stems from the model's ability to improve both motivational and cognitive dimensions of learning, which are essential for long-term academic success.

One of the most effective strategies for promoting enthusiasm and active learning among students is the Problem-Based Learning (PBL) model. Through the PBL approach, students become more engaged in the learning process because they are encouraged to participate actively, ask questions, and collaborate with peers. According to Shofiyah and Wulandari (2018), the real-world relevance of the problems presented through PBL significantly enhances students' intrinsic motivation, which is an essential factor in developing a positive attitude toward learning. This shift from teacher-centered to student-centered learning not only increases student engagement but also fosters a sense of ownership over the learning process. As students gain more control over how they learn, they become more excited and invested in the subject matter. PBL thus serves as an effective pedagogical tool to create dynamic and motivating classroom environments, particularly in IPAS subjects. By stimulating curiosity and critical thinking, the model naturally drives students to be more persistent and enthusiastic in solving academic challenges.

The effectiveness of the PBL model in increasing students' motivation has also been supported by empirical data in this study. The independent t-test value of 0.000 and the noticeable rise in

students' motivation scores before and after the implementation of PBL indicate its substantial impact on learning engagement. This finding supports the conclusion drawn by Arifin et al. (2024), who stated that PBL significantly enhances students' motivation in IPAS classes. The increase in motivation can be attributed to the active role students take in discovering solutions and making sense of the subject matter through collaborative and inquiry-based tasks. Nurhalimah and Meilinda (2023) also emphasized that PBL promotes curiosity and responsiveness, further validating its motivational influence. Students in the experimental group appeared more willing to express ideas, engage with peers, and explore topics more deeply. Yasmini (2021) notes that this approach not only encourages creative and innovative thinking but also builds student confidence, which is a vital component of academic success.

Based on these results, it is evident that the PBL model has a powerful and positive impact on students' learning motivation. The learning experiences provided through this model are typically collaborative, contextual, and designed to reduce feelings of difficulty or boredom, thus helping students to stay actively engaged. According to Nurjanah and Arisona (2021), using PBL increases students' involvement in class and prevents them from losing interest during lessons. These outcomes are consistent with the perspectives of Joyoleksono et al. (2022) and Arifin et al. (2024), who also highlighted the model's potential to stimulate student motivation. The current study's findings confirm that well-structured problem-based instruction makes the learning process more appealing and meaningful. Therefore, by applying this approach, teachers can create a dynamic learning environment that supports motivation and improves educational achievement. With this strong foundation, PBL offers a pedagogical advantage that directly addresses both cognitive and affective learning outcomes in IPAS education.

Hypothesis testing demonstrates the influence of the Problem-Based Learning (PBL) model on the problem-solving abilities of fourth-grade students in IPAS learning. Prior to the treatment, both pretest and posttest data were collected using essay-type written assessments consisting of ten items designed to reflect the four key indicators of problem-solving abilities: understanding the problem, formulating a solution plan, implementing the strategy, and reflecting on the process. The PBL model, which emphasizes critical thinking, independent learning, collaborative teamwork, and problem resolution, was applied to guide students through these stages of intellectual engagement (Ni'mah et al., 2024; Hmelo-silver & Desimone, 2013). The use of PBL provided students with structured opportunities to process real-world issues in a meaningful way while encouraging them to become active participants in their own learning journey. These indicators were instrumental in measuring the extent to which PBL influenced students' ability to identify problems, construct viable strategies, and evaluate their results. As a learning approach, PBL aligns naturally with higher-order thinking competencies, which are increasingly relevant in the context of modern elementary education. This makes the model particularly suitable for addressing complex cognitive tasks like those encountered in IPAS content areas.

The implementation of the PBL model has been shown to significantly enhance students' ability to solve problems in IPAS, as supported by the increase in their posttest scores and an Independent T-Test result of 0.000, indicating statistical significance. This result confirms that students' problem-solving abilities improved notably after they were taught using the PBL model. One of the most beneficial aspects of the model is that it fosters active student engagement through a cycle of exploration, analysis, and presentation. During PBL activities, students are encouraged to investigate the problem deeply, seek relevant information, and propose logical solutions that they later present for class discussion and feedback (Ningtyas et al., 2020). Such processes not only improve their analytical skills but also reinforce communication and reflection—two core components of effective problem-solving. Students in the experimental group, compared to those using the STAD model, exhibited higher average scores in each of the four problem-solving indicators used in this research. Thus, PBL facilitates a deeper learning experience by integrating cognitive effort with social interaction, both of which are essential for building real-world problem-solving competencies.

The PBL model is particularly effective in fostering students' self-confidence and collaborative skills because it positions learners as central agents in resolving authentic, real-world challenges. Ilmiyatni et al. (2019) note that students become more interested and confident in their abilities when they work in groups to find solutions, as they realize that they can handle problems they might face outside of school. In addition, Oktaviana and Haryadi (2020) emphasize that the PBL model has a significantly positive effect on students' problem-solving abilities. The nature of the PBL approach requires students to engage actively in every phase of the learning process, from formulating questions to presenting evidence-based solutions, thereby helping them develop a more systematic approach to tackling problems. However, despite its benefits, the model does present certain implementation challenges, such as managing classroom behavior and maintaining student engagement throughout the process. It also demands that teachers take an active role in facilitating learning, which may require additional training or adaptation. Nonetheless, the gains in student problem-solving competence outweigh these challenges and highlight the potential of PBL as a transformative instructional strategy.

Furthermore, the application of learning models such as PBL is a crucial element in educational practice, as it directly shapes the learning experience and outcomes of students. According to Asyafah (2019), effective learning models are those that align with students' characteristics, reduce boredom, and cultivate a genuine love for learning. ah (2019) supports this view by noting that selecting the right model enhances engagement, increases comprehension, and enriches classroom activities. In this study, the integration of the PBL model into IPAS learning allowed students to engage with the material in ways that traditional approaches often fail to support. It provided a framework for discovery-based learning that not only deepened understanding but also made the learning process more enjoyable and meaningful for students. As a result, students were better able to apply their knowledge to unfamiliar contexts, which is a critical indicator of learning success. This supports the idea that innovative models like PBL are necessary for modern classrooms to meet evolving educational goals.

The advantages of using the PBL model in IPAS teaching have been confirmed by multiple studies. As reported by Lestari et al. (2023), PBL supports student-centered learning environments where thinking skills are developed through continuous, meaningful activity. Additionally, research by Safitri et al. (2023) and Marpaung et al. (2024) further validates the model's impact, stating that PBL enhances both students' problem-solving skills and their learning motivation. The results of this current study echo those findings, as demonstrated by the MANOVA test that yielded a significance value of 0.000, well below the 0.05 threshold. This result confirms that the PBL model has a simultaneous and statistically significant effect on both dependent variables—problem-solving ability and learning motivation. When implemented correctly, the model provides a comprehensive learning framework that nurtures not only intellectual development but also emotional engagement, self-efficacy, and collaborative behavior among students.

Although this study demonstrates the positive impact of the Problem-Based Learning (PBL) model on students' learning motivation and problem-solving abilities in the IPAS subject, several limitations need to be acknowledged. First, the study was conducted in only one elementary school with a limited number of fourth-grade students, which restricts the generalizability of the findings. Different school environments, teacher quality, and student backgrounds may produce varying results. Therefore, caution must be taken when applying the findings to broader educational settings. Another limitation of this research lies in the duration of the intervention. The PBL model was implemented over a relatively short time frame, which may not capture the long-term effects of this learning model on students' cognitive and affective development. Sustained implementation over several semesters could provide deeper insights into how PBL influences academic performance and motivation over time. Additionally, the use of essay-based pretest and posttest instruments, while informative, may not fully reflect the complexity of students' problem-solving processes in real-life learning contexts.

These limitations may affect the depth and sustainability of the observed improvements, but they also highlight areas for further research. Future studies are encouraged to involve larger and more diverse samples, extend the intervention period, and explore mixed-methods approaches to better capture both quantitative and qualitative aspects of student learning. It is also important to investigate how teacher readiness, instructional resources, and school culture support or hinder the effective implementation of PBL in classrooms.

In conclusion, this study establishes that students who were taught using the PBL model outperformed their peers who learned through the STAD model in both learning motivation and problem-solving ability. The structured problem-solving processes embedded in the PBL approach enable students to develop cognitive resilience, confidence, and persistence in addressing complex tasks. When applied consistently, the model cultivates essential 21st-century skills such as critical thinking, teamwork, and self-directed learning. These outcomes support the growing consensus among educators and researchers that PBL is a highly effective model for elementary education, particularly in content areas like IPAS where interdisciplinary thinking is required. Therefore, schools should consider integrating the PBL approach into their curriculum as a strategy not only to enhance academic achievement but also to develop the broader competencies students need to succeed in future learning environments.

CONCLUSION

Although this study demonstrates that the Problem-Based Learning (PBL) model significantly improves learning motivation and problem-solving abilities among fourth-grade students, it has limitations related to the narrow class level and variables examined, which suggests the need for cautious interpretation. Therefore, future research should expand the scope by applying the PBL model across different grade levels and exploring its effects on additional outcomes such as creativity, collaboration, and long-term skill retention. Furthermore, investigating contextual factors like teacher readiness, classroom environment, and school support will provide deeper insights into effective implementation. Such directions will help strengthen the evidence base and offer practical guidance for educators and policymakers to optimize PBL's use in diverse educational settings.

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