The Impact of PBL Model on Science Learning Achievement in Elementary School Students

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Abstract: Elementary education plays an essential role in developing students' foundational scientific understanding and inquiry skills. However, many students still exhibit low engagement in real-world problem-solving, resulting in surface-level understanding of science concepts. This study investigates the effectiveness of the Problem Based Learning (PBL) model in improving science learning achievement among fifth-grade students at SDN 03 South Pontianak. Using a quantitative experimental approach with purposive sampling, pretest–posttest data were analyzed through normality and independent samples t-tests. The findings show a significant increase in learning achievement, with the average score rising from 52.81 (pretest) to 72.66 (posttest), and 78.12% of students achieving mastery. PBL effectively enhances student participation, conceptual understanding, and critical thinking. These results imply that PBL can be used as a strategic model to strengthen science learning in elementary schools, although its implementation requires teacher readiness, structured guidance, and supportive classroom conditions.

Keyword: Problem Based Learning (PBL); Learning Achievement; Science

Introduction

Primary school education is the main foundation for shaping students' knowledge, skills, and attitudes (Nur Latifah et al., 2021). Students are introduced to various subjects designed to develop basic problem-solving skills, curiosity, and social skills that will be useful in everyday life (Hariandi et al., 2023; Sanga, 2023). Through a structured learning process, students are expected not only to master the subject matter, but also to be able to build creativity and care for the environment (Swihadayani, 2023; Wulandari et al., 2023). Science in elementary school is an important subject that aims to instill scientific knowledge, skills, and attitudes in students from an early age (Pratama et al., 2019). Through science learning, students are expected to be able to understand basic concepts about nature and daily life, develop problem-solving skills, and have concern for the environment (Budiarti & Putri, 2022; Fahrurrozi et al., 2022).

Through PBL, students not only receive information from teachers, but are also trained to solve real problems that are close to their daily lives, making learning more meaningful (Pratama et al., 2019). This model also fosters teamwork skills and a sense of responsibility for assigned tasks (Agustin & Nuroh, 2024; Goni & Geor, 2024). With direct involvement in the process of finding solutions, students' understanding of the material, especially science subjects, will be more in-depth, thereby positively impacting their learning achievement (Ahmad et al., 2023; Sagita et al., 2023; Yanti,

2023). Previous studies have shown that PBL is more commonly used at the junior high and high school levels, with a focus on improving critical thinking skills, conceptual understanding, and learning motivation (N. N. Halimah & Riyadi, 2023; Swihadayani, 2023).

Research on the application of PBL at the elementary school level, especially in fifth grade, is still relatively limited. In fact, it is very important to instill problem-solving skills in students starting from elementary school so that they become accustomed to facing more complex learning challenges at the next level. However, the reality in the field shows low student involvement in the problem-solving process. Students are rarely given the opportunity to relate science material to real events in their surroundings. As a result, students only memorize concepts without understanding their application in everyday life (Asniar et al., 2022; Sulastri et al., 2022).

To overcome these problems, an innovative learning model is needed that can increase student activity while improving their learning achievements. One relevant model is PBL (Djonomiarjo, 2020; Utama & Kristin, 2020). PBL is a learning model that emphasizes the presentation of real-world problems as the first step in learning (Anazifa & Djukri, 2017; Ngatman et al., 2025). Students are encouraged to analyze problems, discuss, seek information, and find solutions independently or in groups. Thus, students are more active and creative in understanding science learning (Amin et al., 2021; Handayani et al., 2021).

Thus, the PBL learning model is very relevant for improving student learning achievement. The objectives of this study are: To determine the effect of implementing the PBL learning model on the science learning achievement of fifth-grade students at SDN 03 Pontianak Selatan.

Methods

This study employed a quantitative experimental design using a one-group pretest–posttest model conducted in 2024 at SDN 03 South Pontianak. The population included all fifth-grade students (N = 126), and the sample consisted of 32 students selected through purposive sampling based on class availability and teacher recommendation.The learning process followed five stages of PBL:

1. Problem orientation – students were introduced to real-world science problems.
2. Problem exploration – students gathered information from books and digital sources.
3. Group discussion – students analyzed problems and proposed solutions.
4. Development of solutions – students created concept explanations and reports.
5. Reflection – teacher and students evaluated the learning process.

Instruments & Data Validation

1) Learning achievement was measured using validated pretest and posttest instruments consisting of 20 multiple-choice items.
2) Instrument validity was examined through expert judgment, while reliability was assessed using internal consistency measures.
3) Data analysis included normality tests (Kolmogorov-Smirnov) and independent samples t-tests.

Results And Discussion

Based on the results of the study, it was found that the use of the PBL model can improve learning achievement. Looking at the results, the level of learning achievement with a score of (21.87%) from 7 students obtained a score of < 75, which means they did not complete the course, and (78.12%) from 25 students obtained a score of > 75, which means they completed the course.

Table 1. Level of Learning Achievement

No	Value	Frequency	Percentage
1	<75	7	21,87%
2	75-100	25	78,12%
Jumlah		32	100%

Table 2. Descriptive Analysis of Pretests and Posttests

No	Value	
	Pretest A	***Posttest A***
1	40	75
2	20	75
3	40	85
4	30	80
5	50	80
6	45	60
7	25	70
8	80	65
9	75	75
10	60	65
11	75	75
12	45	60
13	60	90
14	40	50
15	55	70
16	40	75
17	65	40
18	75	65
19	75	65

20	60	70
21	45	80
22	45	90
23	55	70
24	35	80
25	65	85
26	60	80
27	75	75
28	35	75
29	65	85
30	60	70
31	70	80
32	75	65
Jumlah	1.690	2.325
Rata-Rata	52,81	72,66

Table 4. Normality Test

	Class	Kolmogorov-Smirnov[a]		
		Statistic	Df	Sig.
Prestasi Belajar	Pree Test PBL	.107	32	.200
	Post Test PBL	.143	32	0.72

Source: Data processed using SPSS 25

Table 5. Difference Test

Independent Samples Test						
		F	Sig	T	Df	Sig.(2 tailed)
Prestasi	Post Test A	.1.655	.203	-2.171	62	0.34
	Post Test B			-2.171	56.749	0.34

Source: Data processed using SPSS 25

Based on Table 1 of the research results, it can be seen that the application of the PBL model improves student learning achievement. This is indicated by a fairly high learning completeness percentage, namely 78.12%. Meanwhile, only 21.87% or 7 students. This data proves that the majority of students are able to understand the material well through the application of PBL.

Based on Table 2, manual data calculation using Microsoft Excel shows that the average pretest score of students is 52.81, while the average posttest score is 72.66. Based on Table 3, manual data calculation using Microsoft Excel shows that the average posttest score is 44.53, while the average post-pretest score is 77.81.

Based on Table 4, the normality test on the pretest scores yielded a significant result in the PBL class of 0.200 and a significant result for the posttest scores of 0.72. Therefore, it can be concluded that the variables in this study are normally distributed because they have a significance value of more than 0.05 (>0.05).

Based on the test results in Table 5, a significance value of 0.034 was obtained, which is smaller than the probability of 0.05 (0.034 < 0.05).

The results of the study indicate that the application of the PBL learning model has a significant effect on the science learning achievement of fifth-grade students at SDN 03 Pontianak Selatan. This can be seen from the average learning achievement scores after the treatment using the PBL model compared to before using PBL. The use of PBL is able to create a more meaningful and contextual learning experience for students.

The results of the study indicate that the application of the PBL learning model has a positive effect on student learning achievement. This can be seen from the learning completeness percentage, which reached 78.12%, indicating that most students were able to understand the material well after the application of PBL. In addition, the comparison of pretest and posttest scores also showed a significant increase. The average pretest score of 52.81 increased to 72.66 on the posttest, which means that there was an increase in conceptual understanding after the learning process using the PBL model.

The normality test results show that the data are normally distributed because the pretest significance value is 0.200 and the posttest significance value is 0.072, both of which are greater than 0.05. Meanwhile, the difference test (t-test) shows a significance value of 0.034, which is less than 0.05 (0.034 < 0.05). Thus, it can be concluded that there is a significant difference between learning outcomes before and after the implementation of the PBL model, so this model is effective in improving student learning achievement.

These findings are in line with research (Yanti, 2023) which shows that PBL can improve student learning outcomes because they are more active in the learning process. Similar research was also conducted by (rahmadayanti dewi, 2021) which states that PBL plays a role in improving student academic achievement through direct involvement in problem-solving activities.

These results are in line with the theory that problem-based learning can encourage students to be more active, critical, and directly involved in the problem-solving process, so that the knowledge gained becomes more meaningful (S. Halimah et al., 2023; Yanti, 2023). This is supported by (Dellu, 2024) who explains that PBL is designed to help students develop higher-order thinking skills, problem-solving skills, and social skills. In addition, (Djonomiarjo, 2020) states that PBL is an effective learning approach for fostering critical and analytical thinking skills through problem contexts that are relevant to real life.

The implementation of PBL not only has an impact on improving learning outcomes, but also enhances collaboration skills among students (Wela et al., 2020). This is reinforced by research (Amin et al., 2021; Handayani et al., 2021) which shows that PBL can increase student activity, curiosity, and motivation to learn. Thus, PBL not only improves cognitive aspects but also supports the development of students' attitudes and social skills.

In addition, PBL can also help students develop independent learning. PBL emphasizes student-centered learning, where teachers act as facilitators. This encourages students to be more independent in searching for information, processing, and concluding knowledge (Novanto & Darsinah, 2022). Research (Parno et al., 2023) also confirms that students who learn with PBL show better improvement in independent learning skills compared to students who learn with conventional methods.

Thus, it can be concluded that the use of the PBL model is effective in improving student learning achievement. Although there are still a small number of students who have not achieved mastery, overall the high percentage of mastery shows that this model can be a relevant alternative learning strategy to improve the quality of learning. This finding is reinforced by (Zuhri & Sriyanto, 2025) research, which states that PBL can significantly improve student learning outcomes and critical thinking skills. Similarly, research by (Amin et al., 2021) also proves that PBL can create a more interactive learning atmosphere, thereby improving students' understanding of the subject matter.

Conclusion

The study concludes that the Problem Based Learning (PBL) model significantly improves science learning achievement among fifth-grade students at SDN 03 South Pontianak. This is evidenced by the increase in average scores from 52.81 to 72.66 and the high mastery percentage of 78.12%. PBL successfully increases students' involvement in analyzing real-world problems, thus deepening their conceptual understanding.

Practical Suggestions:

1. Teachers should integrate PBL regularly to foster active and meaningful learning.
2. Schools need to support PBL implementation by providing resources and teacher training.
3. Future researchers are encouraged to use control groups, explore student motivation factors, and compare PBL with other models across different school contexts.

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