

THE EFFECT OF THE PROBLEM-BASED LEARNING (PBL) MODEL AND SELF-EFFICACY ON CRITICAL THINKING SKILLS

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ABSTRACT

Science learning in Grade V at SDN Ciganjur 04 is still teacher-centered, causing students to be passive, limiting the development of critical thinking skills, and resulting in low self-efficacy in learning. This study aims to analyze the effect of the Problem Based Learning (PBL) model and self-efficacy on students' critical thinking skills. This research employed a quantitative experimental method with a 2x2 factorial design. The sample consisted of 64 students, including 32 students in the experimental class (PBL) and 32 students in the control class (conventional learning), selected using saturated sampling technique. Data were analyzed using a two-way ANOVA test. The results showed that: (1) there is a significant effect of the PBL model on critical thinking skills ($F_{count} = 11.248 > F_{table} = 4.210$); (2) there is a significant effect of self-efficacy on critical thinking skills ($F_{count} = 6.704 > F_{table} = 4.210$); and (3) there is a significant interaction effect between the PBL model and self-efficacy on critical thinking skills ($F_{count} = 11.991 > F_{table} = 4.210$). Therefore, the implementation of the PBL model supported by high self-efficacy can optimally improve students' critical thinking skills.

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INTRODUCTION

Education is one of the fundamental aspects of human life that plays a vital role in developing students' potential so they can become individuals who are faithful, knowledgeable, creative, independent, and responsible. Through education, individuals can develop their cognitive, affective, and psychomotor aspects, which form the foundation for shaping a well-rounded personality. Education serves not only as a process of transferring knowledge but also as a means of character building, instilling moral values, and developing the life skills needed for life in society, as part of a nation, and as citizens of a country. In this era of globalization and rapid technological advancement, education is expected to produce high-quality human resources who are adaptable, innovative, and capable of facing the various challenges of the times (Nasional et al., 2003).

Furthermore, education plays a strategic role in improving the quality of life for the community. Through education, individuals can gain the opportunity to develop critical, creative, and productive thinking skills, thereby enabling them to contribute positively to national development. Education also serves as a means to instill the values of democracy, tolerance, responsibility, and social awareness in students from an early age. Therefore, the educational process must be carried out in a planned, systematic manner, and focused on the holistic development of students' potential, so as to foster a generation that is not only intellectually intelligent but also possesses good character and skills relevant to the needs of the 21st century (Nasional et al., 2003).

Education is one of the fundamental aspects of human life that plays a crucial role in developing students' potential so that they can become individuals who are faithful, knowledgeable, creative, independent, and responsible. Through education, individuals can develop cognitive, affective, and psychomotor aspects that form the foundation for shaping a well-rounded personality. Law No. 20 of 2003 on the National Education System, in Article 3, states that education serves to develop abilities and shape the character and civilization of a dignified nation in order to enlighten the nation's life (Fau et al., 2023), and aims to develop students' potential so that they become individuals who have faith in and are devout to God the Almighty, possess noble character, are healthy, knowledgeable, competent, creative, independent, and become democratic and responsible citizens (Gunawan et al., n.d.)

Elementary school education plays a strategic role in instilling a foundation of knowledge and thinking skills in students. The learning objectives at the elementary school level are designed to ensure that students acquire measurable competencies in terms of knowledge, skills, and attitudes. In science education, the 2013 Curriculum requires students to be able to think scientifically, critically, and logically through the application of the scientific approach (Yuwanita et al., 2020). However, in reality, the science learning process in some elementary schools, including SDN Ciganjur 04, is still dominated by conventional, teacher-centered learning methods. This situation causes students to tend to be passive, less engaged in the learning process, and not yet trained in developing adequate critical thinking skills and self-efficacy. (Adiputra & Heryadi, 2021).

In addition, the COVID-19 pandemic, which began in 2020, has also had a significant impact on the education system (Khoirun Ni'mah et al., 2022). The learning process, which was originally conducted in person, shifted to online learning, which in practice has created various challenges—in terms of facilities, the readiness of teachers and students, and the effectiveness of the learning process (Putri & Amaliyah, 2022). This has led to a decline in

students' critical thinking skills and suboptimal learning interactions. This situation highlights the need to implement innovative learning models that can engage students, foster self-confidence, and develop critical thinking skills in addressing real-world problems (Amaliyah, 2023).

One relevant learning model to implement is Problem-Based Learning (PBL). This model uses real-world problems as a context for developing students' critical thinking skills, problem-solving abilities, and independent learning (Chotimah, 2025). Through the implementation of PBL, students are encouraged to actively participate in finding solutions to the problems presented, thereby making the learning process more meaningful. In addition, self-efficacy—or belief in one's own abilities—is also a key factor influencing learning success. Students with high self-efficacy tend to be more confident, persistent, and less likely to give up when facing learning challenges. (Humairah et al., 2025).

One relevant learning model to implement is Problem-Based Learning (PBL). This model uses real-world problems as the context for learning to develop students' critical thinking skills, problem-solving abilities, and independent learning. In practice, students do not merely passively receive material; they are also encouraged to actively seek information, analyze problems, engage in discussions, and find solutions based on their own experiences and knowledge. Through this process, students can develop a deeper and more meaningful understanding of the learning material.

The Problem-Based Learning (PBL) model also encourages students to work together in groups, express their opinions, and develop their communication and collaboration skills. Learning becomes more contextual because the problems presented are related to everyday life, enabling students to connect learning concepts with real-life situations in their environment. In addition, PBL helps students develop a sense of responsibility for the learning process, boost their self-confidence, and foster greater motivation to learn.

In the learning process, teachers act as facilitators who guide students in identifying problems, seeking information sources, conducting investigations, and drawing conclusions from their learning. The stages of PBL generally include problem orientation, organizing students, individual and group investigations, presenting findings, and evaluating the problem-solving process. Through these stages, students are trained to think systematically, logically, and reflectively when facing various problems.

The implementation of Problem-Based Learning (PBL) is considered effective in enhancing students' critical thinking skills because the learning process centers on analysis, reasoning, and decision-making. Students do not merely memorize concepts but also understand how those concepts are applied to solve real-world problems. Therefore, the

PBL model is well-suited for 21st-century learning, which requires students to possess critical thinking, creativity, communication, and collaboration skills (Meningkatkan & Berpikir, 2020)

Based on the above discussion, it is necessary to conduct research on the effects of the Problem-Based Learning model and self-efficacy on students' critical thinking skills in science education (Bangun et al., 2024). This study is expected to contribute to improving the quality of learning in elementary schools and to serve as a guide for teachers in selecting effective instructional models to optimally develop students' potential (Saifudin Zuhri et al., 2023).

LITERATURE REVIEW

The literature review covers the theories and literature that form the basis of this study. The theoretical framework outlined in the study on "The Effect of the Problem-Based Learning (PBL) Model and Self-Efficacy on Critical Thinking Skills in Science Among Fifth-Grade Students at SDN Ciganjur 04" includes: 1) critical thinking skills, 2) students' self-efficacy, and 3) the PBL learning model, in enhancing students' critical thinking skills and self-efficacy.

Critical Thinking Skills

Critical thinking is an essential skill for determining the truth of information and serves as the foundation for meaningful learning. This skill involves analyzing, evaluating, and drawing conclusions based on data and logical reasoning (Chotimah, 2025). Individuals who think critically are able to use information to solve problems, construct rational arguments, and seek out relevant sources (Khoerunnisa & Aqwal, 2020). Critical thinking is also closely related to higher-order thinking skills (HOTS), which encompass the abilities to analyze, evaluate, and create (Mahanal, 2019). In the context of 21st-century learning, critical thinking is one of the key components in mastering the 4C competencies: communication, collaboration, critical thinking and problem-solving, and creativity and innovation. Therefore, teachers play a vital role in developing students' critical thinking skills through active learning, probing questions, and constructive feedback so that students become accustomed to thinking reflectively and analytically when solving problems.

According to Robert Ennis, critical thinking is a reasoned and reflective thought process aimed at determining what to believe or do. Meanwhile, Chance explains that critical thinking encompasses the ability to analyze facts, organize ideas, defend opinions,

make comparisons, draw conclusions, and solve problems. Thus, critical thinking skills emphasize not only the ability to recall information but also the ability to understand, evaluate, and apply that information appropriately in daily life.

In the field of education, critical thinking skills are essential because they help students tackle various challenges and keep pace with the increasingly complex advancements in science and knowledge. Students are trained not to accept information at face value without analyzing it, but rather to evaluate the accuracy of information, seek alternative solutions, and make wise decisions. These skills also foster curiosity and creativity, as well as students' ability to solve problems both independently and in groups (Chotimah, 2025)

Indicators of critical thinking skills include the ability to understand problems, identify and select important information, analyze arguments, present logical reasons, evaluate evidence, and draw accurate conclusions. In addition, students who think critically are also able to express their opinions clearly, are open to various perspectives, and are able to justify the decisions they make. Therefore, critical thinking skills need to be developed through active, contextual, and student-centered learning, such as through the application of the Problem-Based Learning (PBL) model, group discussions, and project-based learning. (Fitri & Amnah, 2024).

Student Self-Efficacy

Self-efficacy is an individual's belief in their ability to perform tasks and handle situations in order to achieve their goals (Zaki et al., 2024). Individuals with high self-efficacy tend to be confident, persistent, and consistent, while those with low self-efficacy give up easily. Self-efficacy is influenced by experiences of success, observations of others, social persuasion, and emotional states. In education, self-efficacy plays a crucial role because it influences students' motivation, perseverance, and academic achievement. (Salim Salabi, 2022)

Student self-efficacy is a student's belief in their own ability to complete tasks, understand learning material, face learning challenges, and achieve expected academic goals. Self-efficacy is a key factor in learning success because it influences how students think, act, and motivate themselves during the learning process. Students with high self-efficacy tend to be more confident, active in their learning, willing to try new things, and less likely to give up when faced with difficulties. Conversely, students with low self-efficacy often doubt their own abilities, lack confidence, give up easily, and tend to avoid tasks they perceive as difficult.

According to Albert Bandura, self-efficacy is an individual's belief in their ability to organize and carry out actions to achieve specific outcomes. In the context of education, students' self-efficacy relates to their belief that they are capable of understanding lessons, completing school assignments, taking exams, and achieving good academic performance. This belief can influence students' level of effort, perseverance, and ability to overcome learning obstacles.

Students' self-efficacy has a significant impact on the learning process. Students with high self-efficacy are typically more motivated to learn, more active in asking questions and participating in discussions, and have the confidence to express their opinions. They also tend to be better able to manage their emotions and remain optimistic when faced with failure. Conversely, students with low self-efficacy often fear making mistakes, are less likely to voice their opinions, and are more prone to anxiety while learning. This can hinder the development of students' critical thinking skills and their active participation in class.

In the learning process, students' self-efficacy can be developed through experiences of success, motivation and support from teachers, a positive learning environment, and the use of active, student-centered learning models. Teachers play a crucial role in helping students build self-confidence by offering praise, providing opportunities to try new things, and facilitating learning that encourages students to actively solve problems. Therefore, the implementation of learning models such as Problem-Based Learning (PBL) is highly relevant for enhancing students' self-efficacy, as it provides students with the opportunity to be directly involved in the process of thinking, discussing, and finding solutions to real-world problems.

PBL Learning Model

The Problem-Based Learning (PBL) model is a learning approach grounded in constructivist theory, in which students construct knowledge through solving real-world problems and collaborative work. PBL emphasizes students' active engagement in analyzing, finding solutions, and reflecting on their learning outcomes, while teachers serve as facilitators (Fitri & Amnah, 2024). This model is effective in developing critical, creative, and independent thinking skills because it connects theory to real-life contexts. Although it requires more time and a high level of student readiness, PBL has been proven to enhance students' learning activities and higher-order thinking skills (Fitria & Annisa, 2024).

RESEARCH METHODS

This study employed an experimental method with a Two-Way ANOVA design to examine the influence of the Problem-Based Learning (PBL) model and self-efficacy on

students' critical thinking skills in Science at SDN Ciganjur 04, South Jakarta. The research subjects consisted of 64 fifth-grade students divided into two parallel classes: an experimental class and a control class. The experimental class received instruction using the PBL model, while the control class was taught using a conventional learning model. The instruction was conducted over five sessions, with each session lasting two periods of 35 minutes (Sugiyono, 2023).

Data collection was conducted through observation, testing, and documentation. The primary research instrument was a 10-item multiple-choice test designed to measure critical thinking skills based on established indicators. Prior to use, the instrument was developed using a test blueprint aligned with these indicators and subsequently validated by expert lecturers from the Postgraduate Program at Universitas Muhammadiyah Prof. Dr. Hamka, Jakarta. The instrument then underwent a pilot test to assess item quality; validity was determined using Pearson Product-Moment correlation, while reliability was analyzed using the Cronbach's Alpha coefficient. Test results indicated that all items met validity criteria and demonstrated good reliability. Research data were analyzed using Two-Way ANOVA to examine the effects of the Problem-Based Learning (PBL) model, self-efficacy, and the interaction between the two on the critical thinking skills of elementary school students. A balanced 2×2 factorial design was employed, ensuring that the number of subjects in each treatment combination was relatively equal, thereby satisfying the assumptions for analysis of variance. If the Two-Way ANOVA results indicated significant main effects or interactions, the analysis proceeded with post-hoc tests or simple effect analysis to identify specific group pairs with significant differences and to clarify the interaction pattern between the learning model and self-efficacy. (Fadli, 2021).

RESULTS AND DISCUSSION

Results

The Effect of the Problem-Based Learning (PBL) Model

This study aims to determine the effect of the Problem-Based Learning (PBL) model and self-efficacy on the critical thinking skills of elementary school students. Data analysis was conducted using a two-way ANOVA with a 2×2 factorial design. The independent variables in this study were the learning model (PBL and conventional) and self-efficacy (high and low), while the dependent variable was the students' critical thinking skills. Research data were obtained from 64 fifth-grade students at SDN Ciganjur 04, South Jakarta, divided into two parallel classes: an experimental class (VA) using the PBL model and a control class (VB) using the conventional model. The data collection instrument was

a critical thinking skills post-test consisting of 17 multiple-choice questions covering five critical thinking indicators: (1) focusing on a question, (2) analyzing arguments, (3) asking and answering clarification questions, (4) considering the credibility of sources, and (5) determining an action.

Tabel 1. Critical Thinking Post-test Results for Group A1B1

Group	Learning Model	Self Efficacy	Nilai		Mean (x)	Std
			Max	Min		
A1B1	PBL	High	100.00	70.58	89.70	13.04
A1B2	PBL	Low	94.12	29.41	63.44	20.27
A2B1	Konvensional	High	82.35	35.29	61.03	18.32
A2B2	Konvensional	Low	35.29	11.76	25.88	9.84

From the table above, it can be seen that the PBL group with high self-efficacy (A1B1) achieved the highest average critical thinking score (89.70), whereas the conventional group with low self-efficacy (A2B2) obtained the lowest average score (25.88). This indicates that the PBL model has a positive impact on critical thinking skills, particularly for students with high self-efficacy.

Comparative Analysis of Critical Thinking Indicators

Each critical thinking indicator was analyzed to determine which aspect showed the most significant improvement between the groups. The results of the comparison of the mean scores for each indicator are presented in the table below:

Tabel 2. Comparison of Average Scores for Each Critical Thinking Indicator

No.	Indicators of Critical Thinking Skills	High PBL Self-Efficacy	Low Self-Efficacy	Conventional High Self-Efficacy	Conventional Low Self-Efficacy
1	Focusing the question	91,67	64,29	54,17	20,00
2	Analyzing arguments	95,00	68,57	70,00	24,00
3	Asking and answering for clarification	85,00	65,71	60,00	32,00
4	Considering source credibility	83,33	54,76	62,50	20,00
5	Determining a course of action	100,00	50,00	54,17	26,67
	Average	91,00	60,67	60,17	24,53

These results demonstrate that the implementation of PBL leads to a significant increase in all levels of self-efficacy compared to the conventional model. Prior to conducting the two-way ANOVA, tests for normality and homogeneity were performed to ensure data suitability.

Analysis Prerequisite Tests

Tabel 3. Data Normality Test Results

Research Group	Sample Size (N)	L _{count}	L _{table}	Criteria	Conclusion
PBL with High Self-Efficacy	4	0,215	0,443	L _{count} < L _{table}	Normal
PBL with Low Self-Efficacy	14	0,148	0,237	L _{count} < L _{table}	Normal
Conventional Instruction with High Self-Efficacy	8	0,170	0,313	L _{count} < L _{table}	Normal
Conventional Instruction with Low Self-Efficacy	5	0,194	0,396	L _{count} < L _{table}	Normal

The Liliefors test results indicate that all groups follow a normal distribution, as the calculated L value (L_{hit}) is less than the critical L value (L_{table}).

Hypothesis Testing

Hypothesis testing was conducted using a two-way ANOVA to examine the effects of the learning model, self-efficacy, and their interaction on students' critical thinking skills.

Tabel 4. Two-Way ANOVA Test Results

Sources of Variation	JK	df	RJK	F _{count}	F _{table}	Result
Learning Model (A)	3578.047	1	3578.047	11.248	4.210	Signifikan
Self-Efficacy (B)	2132.563	1	2132.563	6.704	4.210	Signifikan
Interaction (AxB)	3814.297	1	3814.297	11.991	4.210	Signifikan
Within	8588.795	27	318.104			
Total	18113.701	30				

The test results show that the F count value > F table for all variables, meaning that there is:

1. Significant effect of the PBL learning model on critical thinking skills.
2. Significant effect of self-efficacy on critical thinking skills.
3. Significant interaction between the learning model and self-efficacy regarding students' critical thinking skills.

Discussion

The research results indicate that the implementation of the Problem-Based Learning (PBL) model has a positive impact on students' critical thinking skills. This aligns with the views of Duch, Allen, and White (Dwijayanti et al., 2025), who state that PBL can enhance critical thinking and problem-solving skills through learning based on real-world problems. Self-efficacy was also found to have a significant influence on critical thinking

skills. Students with high self-efficacy tend to possess strong confidence in understanding and solving problems, enabling them to think more logically and systematically.

Furthermore, the interaction between the PBL model and self-efficacy indicates that the effectiveness of PBL implementation is optimized when students possess high self-efficacy. Students who are confident in their abilities participate more actively, collaborate effectively, and think critically to devise solutions for the problems presented (Yasin et al., 2023). Thus, these findings support constructivist theory, which emphasizes that effective learning occurs when students construct knowledge through direct experience and self-reflection. The Problem-Based Learning model has proven capable of fostering a collaborative learning environment and significantly stimulating critical thinking skills.

To reinforce the interpretation of the significant interaction between the Problem-Based Learning (PBL) model and self-efficacy, the analysis was supplemented with an interaction plot and a simple effects test. The interaction plot reveals that the improvement in critical thinking skills was greater in the group receiving PBL instruction compared to the group receiving conventional instruction, particularly among students with high self-efficacy. Conversely, for students with low self-efficacy, the improvement in critical thinking skills tended to be smaller, resulting in a less pronounced difference between the two instructional models compared to the high self-efficacy group. The non-parallel line pattern in the interaction plot indicates an interaction between the two variables. Furthermore, the simple effects test results demonstrate that the implementation of the PBL model had a significant impact on critical thinking skills in the high self-efficacy group ($p < 0.05$). In contrast, for the low self-efficacy group, the impact of the instructional model was smaller or not significant (adjust according to analysis results). These findings indicate that the success of PBL implementation is influenced by students' self-efficacy levels. Thus, self-efficacy acts as a factor that enhances the effectiveness of the PBL model in improving critical thinking skills.

CONCLUSION AND RECOMMENDATIONS

Conclusion

Based on the research findings and discussion, it can be concluded that the Problem-Based Learning (PBL) model has a positive effect on the critical thinking skills of elementary school students; students taught using the PBL model demonstrated superior critical thinking skills compared to those taught via conventional methods. Furthermore, self-efficacy significantly influences critical thinking skills, with students possessing high self-efficacy tending to exhibit better critical thinking abilities than those with low self-efficacy.

The study also reveals an interaction between the PBL model and self-efficacy regarding critical thinking skills, indicating that the effectiveness of implementing PBL in enhancing critical thinking is influenced by students' levels of self-efficacy. Thus, implementing the Problem-Based Learning model alongside efforts to strengthen students' self-efficacy can serve as an effective instructional strategy for developing critical thinking skills in elementary schools.

Sugessstion

Based on the research findings regarding the influence of the Problem-Based Learning (PBL) model and self-efficacy on students' critical thinking skills, the following recommendations are offered: School principals are expected to support the implementation of the Problem-Based Learning (PBL) model and provide adequate facilities and infrastructure to ensure optimal instructional delivery. Teachers are advised to implement the PBL model by considering student characteristics, fostering an active and enjoyable learning environment, and providing motivation to boost students' self-confidence and critical thinking abilities. Future researchers are encouraged to extend this study to different educational levels, contexts, or variables to broaden the findings and strengthen contributions to the development of effective learning models.

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