



The influence of PBL, PjBL, and critical thinking ability on learning outcomes

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ABSTRACT

Students' disinterest in learning civic education is primarily attributed to the limited application of innovative learning models and the weak critical thinking skills of students, as evident in their approach to problem-solving. Few students demonstrate the courage to argue in class. The purpose of this study was to investigate the impact of problem-based learning models, project-based learning, and students' critical thinking skills on student learning outcomes. The data collection technique employed was a questionnaire with multiple-choice questions. Hypothesis testing was conducted using two-way analysis of variance (ANOVA) with Tukey test. The results showed that there were differences in the learning outcomes of students who were treated with problem-based learning models and project-based learning models, there were interactions between learning models and students' critical thinking skills, there were learning outcomes of students who had high critical thinking skills taught with PJBL models better than PBL models, and there were learning outcomes of students who had low critical thinking skills taught with PBL models better than PJBL models. It can be concluded that the PBL and PJBL models affect the critical thinking ability and learning outcomes of grade V students at MIS Nurus Salam Deli Tua.

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ABSTRAK

Ketidaktertarikan peserta didik dalam pembelajaran pendidikan kewarganegaraan disebabkan oleh kurangnya penerapan model pembelajaran yang inovatif dan lemahnya kemampuan berpikir kritis peserta didik dilihat dari cara peserta didik ketika menghadapi permasalahan. Terdapat sedikit peserta didik yang menunjukkan keberanian dalam berargumen di kelas. Tujuan penelitian untuk mengetahui pengaruh model pembelajaran problem based learning, project based learning, dan kemampuan berpikir kritis peserta didik terhadap hasil belajar peserta didik. Metode penelitian ini adalah eksperimen dengan desain faktorial 2 x 2. Teknik pengumpulan data yang digunakan yaitu kuesioner dengan soal pilihan berganda. Pengujian hipotesis dilakukan menggunakan analysis of variance (ANOVA) dua jalur dengan uji Tukey. Hasil penelitian menunjukkan terdapat perbedaan hasil belajar peserta didik yang diberi perlakuan model problem based learning dan model project based learning pada peserta didik, terdapat interaksi antara model pembelajaran dan kemampuan berpikir kritis peserta didik, terhadap hasil belajar peserta didik yang memiliki kemampuan berpikir kritis tinggi yang diajarkan dengan model PJBL lebih baik dari model PBL, serta terdapat hasil belajar peserta didik yang memiliki kemampuan berpikir kritis rendah yang diajarkan dengan model PBL lebih baik dari model PJBL. Dapat disimpulkan bahwa Terdapat pengaruh model PBL dan PJBL terhadap kemampuan berpikir kritis dan hasil belajar peserta didik kelas V MIS Nurus Salam Deli Tua.

Kata Kunci: berpikir kritis; hasil belajar; model pembelajaran

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INTRODUCTION

In achieving educational objectives, the curriculum in formal education is developed based on the principle of diversification, which is adapted to regional potential, local conditions, and the specific needs of schools and students (Zulaiha & Wahyudin, 2024). KStudents' needs are often closely related to realizing more effective learning, providing meaningful experiences, and developing problem-solving skills in alignment with the competencies required in the current century. One of the efforts made by teachers in delivering instruction is to actively engage students in the learning process (Millah, 2015). Traditional methods such as lecturing, rote memorization, and textbook-based material presentation are often insufficient to actively involve students in constructing the concepts being taught. Therefore, the learning process should adopt alternative approaches that provide equal opportunities for each student's unique abilities, recognizing the diversity among learners. In the 21st century, elementary school students are expected to develop critical thinking skills, as they play a more active role in the learning process, with the teacher serving as a facilitator, an approach commonly referred to as student-centered learning (Syawalia et al., 2023).

Students' high critical thinking ability can significantly influence their academic achievement. Learning outcomes, defined as the competencies acquired by individuals through the learning process, reflect changes in behavior, encompassing knowledge, understanding, attitudes, and skills, demonstrating improvement compared to prior states. One subject that clearly illustrates such behavioral change is Civic Education (Pendidikan Kewarganegaraan), which serves as a guide for every citizen in social, national, and state life. Observations of fifth-grade students (Class V-2) at MIS Nurus Salam Deli Tua indicate that some students still rely heavily on textbook answers and have yet to demonstrate independent thinking in thematic Civic Education (PPKn) learning. Their critical thinking skills have not been sufficiently cultivated, particularly in formulating questions or explaining in their own words. This is even though critical thinking is highly beneficial for elementary school students, as they are at an age characterized by the development of concrete thinking, which is influenced by both external and internal factors.

A viable solution to enhance students' critical thinking skills is the implementation of innovative instructional models, namely Problem-Based Learning (PBL) and Project-Based Learning (PjBL). The PBL model emphasizes problem-solving, positioning students as active learners expected to resolve real-world problems the teacher presents. In contrast, the teacher acts primarily as a facilitator (Seibert, 2021). Previous studies have indicated that the PBL model effectively stimulates critical thinking skills through its problem-oriented learning process (Stephani, 2017). Furthermore, PBL has been shown to enhance critical thinking abilities and student learning outcomes significantly (Islamiati et al., 2024; Pangesti & Radia, 2021; Rambe et al., 2024). In addition, other research findings highlight that the PjBL model can also improve students' critical thinking skills (Abdullah & Ningrum, 2024; Al Munawar et al., 2025). Unlike prior studies focusing on only one learning model, this research investigates the effects of both PBL and PjBL. This study examines the influence of the PBL and PjBL learning models on students' critical thinking skills and learning outcomes.

LITERATURE REVIEW

Problem-Based Learning (PBL) Model

Problem-Based Learning (PBL), or problem-based instruction, originates from the English term Problem-Based Instruction (PBI). PBL is an interactive process involving stimulus and response, representing a reciprocal relationship between learning and the environment (Fajriah et al., 2021; Larosa et al., 2024). In this context, the environment provides input to students in the form of support and real-world problems. The brain's neural system functions to interpret these inputs effectively, allowing students to investigate,

evaluate, analyze, and solve the problems they encounter. This instructional model is well-suited for developing both fundamental and complex knowledge. Several key features characterize the problem-based learning model: 1) Learning begins with a problem; 2) The problem presented must be relevant to students' real-world experiences; 3) Learning is organized around the problem, rather than around academic disciplines; 4) Students are given significant responsibility in shaping and directing their learning process; 5) Learning is conducted in small groups; and 6) Students are required to demonstrate what they have learned through the creation of products and performance-based tasks.

PBL enhances students' motivation and engagement by promoting self-directed learning as they actively seek information and practice problem-solving (Asri et al., 2024). In primary education, PBL has been shown to increase teacher enthusiasm and students' learning abilities, although specific challenges in its implementation remain. Furthermore, PBL can be adapted to various educational contexts, as illustrated by its alignment with the Space-Time Continuum framework, which supports diverse pedagogical strategies depending on the learning environment (Higuera-Martínez et al., 2022). In addition, PBL has been proven effective in developing students' problem-solving skills and fostering their independence in learning. Factors that significantly contribute to the enhancement of critical thinking abilities (Handoyo et al., 2024). Overall, PBL is a valuable instructional approach that equips students with essential skills required to meet the demands of the 21st-century workforce.

Project-Based Learning (PjBL) Model

Project-Based Learning (PjBL) is an instructional model that shifts classroom activities from traditional, short, isolated teacher-centered lessons to a student-centered approach, with the teacher as a facilitator (Athaya et al., 2024). PjBL is expected to provide solutions for addressing real-world problems by creating ideas or products that leverage the existing environment (Mustofiyah, 2020). Students actively deepen their learning through a research-based approach to problems and questions that are meaningful, real, and relevant. PjBL is a learning method that centers on training processes based on real-world issues, conducted through specific activities (projects). Project-based learning offers students the opportunity to explore material in ways that are meaningful to them and to collaborate in conducting experiments (Widiyatmoko & Pamelasari, 2012).

PjBL is characterized by its emphasis on student-centered experiential learning, fostering critical thinking, problem-solving, collaboration, and communication skills. This educational approach engages students in direct projects integrating various academic subjects, allowing them to explore complex questions and create real-world products or solutions. The steps in the PjBL model include: 1) Starting with an essential or guiding question; 2) Being completed over an extended period (several weeks or months); 3) Focusing on a final product or "artifact" (which may take the form of written, oral, visual, or multimedia products), as well as production activities that require. The scope and timeframe of projects vary, and the final product can differ significantly in terms of the technology and sophistication involved; and 4) The learning outcomes are represented by products such as prototypes, art posters, or performances (Dinda & Sukma, 2021).

The steps for implementing the PjBL instructional model can be carried out through the following stages: 1) Preparation of questions or project assignments as an initial step to encourage students to delve deeper into the questions arising from existing phenomena; 2) Designing the project plan as a tangible step to address the existing questions by developing a project plan, which may include experiments; 3) Developing a schedule as a concrete step in the project. Scheduling is crucial to ensure that the project is completed within the available time and meets the established targets; and 4) Monitoring activities and the project progress. Students evaluate the project they are working on (Noviati, 2021).

Critical Thinking

Critical thinking encompasses a range of cognitive skills essential for evaluating information, solving problems, and making sound decisions. It involves careful reasoning, taking different perspectives, and the ability to assess various arguments and solutions (Milala et al., 2024). Critical thinking is increasingly recognized as a vital educational skill, particularly in fostering independent thought and active citizenship. The following section outlines the key components and their significance. Recognizing and defining problems is the foundation of critical thinking (Malinda et al., 2022). Critical thinkers reflect on their reasoning processes, identifying biases and errors. Critical thinking is a primary goal in educational settings, enhancing students' ability to engage with complex issues (Gunawan et al., 2022). It encourages viewing problems from multiple perspectives, promoting innovation and interdisciplinary collaboration. It can be concluded that critical thinking is essential for both personal and social progress, and its emphasis in education can complement other important skills, such as creativity and emotional intelligence, for holistic development.

Learning Outcomes

Learning outcomes, in essence, refer to changes in behavior. As a result of learning in a broad sense, behavior encompasses the cognitive, affective, and psychomotor domains. Learning outcomes are the achievements attained by an individual after engaging in the learning process, which includes cognitive, affective, and psychomotor aspects. These outcomes can be represented through symbols, numbers, letters, or sentences that reflect the quality of an individual's activities in a specific process (Ammy & Wahyuni, 2020). Learning outcomes signify changes in behavior and students' abilities after the learning process, typically expressed as grades that measure knowledge, behavior, and skills (Moko et al., 2022).

METHODS

This study employs a quantitative research method with an experimental research design to determine the existence of causal relationships. The research design used is a 2 x 2 by-level design with three research variables: one moderator variable, one dependent variable, and two independent variables. The dependent variable is students' critical thinking, the moderator variable is critical thinking, and the two independent variables are the PBL model. The instructional models' treatment variables are differentiated into the PBL model (A1) and the PjBL model (A2). The influencing variables are students with high critical thinking (B1) and students with low societal era thinking (B2). Sampling was conducted using the randomized group design technique, where subjects were randomly assigned to different groups under varying conditions or independent variable values. In this design, subjects were randomly assigned to only two groups, with sampling focused on the population size. Group assignment was done randomly through a draw containing labels "Problem-Based Learning class" and "Project-Based Learning class." From the draw, each group consisted of 36 students from Class V-2 for the PBL group and 36 from Class V-3 for the PjBL group.

The two groups were treated differently with distinct instructional methods, namely PBL and PjBL. Then, each student was given a test to assess their learning outcomes and critical thinking abilities. The test results from each class were arranged according to the scores, from the highest to the lowest. The survey data were separated by group, and then the average test results were calculated to determine the students with high and low critical thinking, based on the procedure outlined by Frank M. Verducci, which involves selecting 27% of the highest and 27% of the lowest scores. From this calculation, 27% of each group's highest and lowest scores is $27\% \times 36 = 9.72$, rounded to 10 students (for the Problem-Based Learning group) and $27\% \times 36 = 9.72$, rounded to 10 students (for the Project-Based Learning group). Subsequently,

raw data were processed to find the mean, median, mode, standard deviation, range, maximum, and minimum values. Frequency distribution was visualized through tables and histograms. Hypothesis testing was conducted using a two-way analysis of variance (ANOVA) with Tukey's test to determine which group exhibited better critical thinking, performed at a significance level of $\alpha = 0,05$.

RESULTS AND DISCUSSION

From the learning outcomes data, students who learned using the PBL model with high critical thinking abilities (A1B1) had scores ranging from 65 to 95, with an average score of 77.5 and a standard deviation of 9.2.

Table 1. Distribution(A1B1)

No	Interval Class	FA	FR%
1	65-69	1	10%
2	70-74	2	20%
3	75-79	3	30%
4	80-84	2	20%
5	85-89	0	0
6	90-95	2	20%
Amount		10	100%

Source: Research 2024

Table 1 shows that one student (10%) obtained learning outcomes below the average.

Table 2. Distribution (A2B1)

No	Interval Class	FA	FR%
1	60-65	4	40%
2	66-71	0	0%
3	72-77	3	30%
4	78-83	2	20%
5	84-89	1	10%
Amount		10	100%

Source: Research 2024

Table 2 shows that four students (40%) obtained learning outcomes below the average. The learning outcomes data show that students who learned using the PjBL model with low critical thinking abilities (A2B1) had scores ranging from 60 to 85, with an average score of 72 and a standard deviation of 8.88.

Table 3. Distribution (A1B2)

No	Interval Class	FA	FR%
1	55-61	2	20%
2	62-68	2	20%
3	69-75	5	50%
4	76-82	0	0%
5	83-89	1	10%
Amount		10	100%

Source: Research 2024

Table 3 shows that two students (20%) obtained learning outcomes below the average. The learning outcomes data show that students who learned using the PBL model with low critical thinking abilities (A1B2) had scores ranging from 55 to 85, with an average score of 79 and a standard deviation of 8.82.

Table 4. Distribution Frequency (A2B2)

No	Interval Class	FA	FR%
1	75-80	2	20%
2	81-86	1	10%
3	87-92	2	20%
4	93-98	2	20%
5	99-104	3	30%
Amount		10	100%

Source: Research 2024

Table 4 shows that two students (20%) obtained learning outcomes below the average. The learning outcomes data show that students who learned using the PjBL model with low critical thinking abilities (A2B2) had scores ranging from 75 to 100, with an average score of 91 and a standard deviation of 8.76.

Normality Test

The learning outcomes scores for the students in Class V at MIS Nurus Salam Deli Tua were normalized using the Lilliefors test at a significance level of $\alpha = 0.05$. Table 5 summarizes the normality test results for the sample.

Table 5. Summary of the Sample Normality Test Results

Group	N	Lo	Lt	Conclusion
A₁B₁	10	0,1936	0.258	Normal
A₁B₂	10	0,1843	0.258	Normal
A₂B₁	10	0,1852	0.258	Normal
A₂B₂	10	0,1515	0.258	Normal

Source: Research, 2024.

Description:

Lo = lilliefors observation

Lt = lilliefors table

Based on **Table 5**, the L_o for all sample groups is smaller than the L_t . This suggests that the sample comes from a population with a normal distribution. Therefore, this result implies that parametric statistical analysis can be used to test the hypotheses proposed in this study, thus fulfilling the first requirement for testing.

Homogeneity Test

The homogeneity of variance test for each group of the learning outcomes data was conducted using the Bartlett test at a significance level of $\alpha = 0.05$. The Bartlett test determines whether the sample groups come from populations with the same variance. The sample groups can consist of any number, but the Bartlett test is typically used when testing more than two samples/groups. Equal variance across samples is referred to as homoscedasticity or homogeneity of variance. The Bartlett test is required in several statistical tests, including Analysis of Variance (ANOVA), as a prerequisite for using ANOVA. The results of the homogeneity test for the four groups are presented in **Table 6**.

Table 6. Summary of the Homogeneity Results of 4 Groups

Group	N	X^2h	X^2t	Conclusion
A_1B_1	10	0,09	7,81	Homogen
A_1B_2	10			
A_2B_1	10			
A_2B_2	10			

Source: Research, 2024

Description:

X^2h = Homogeneity observation

X^2t = Homogeneity table

It can be concluded that the results of the homogeneity test in this study indicate that the groups are homogeneous, as the value of $X_h < X_t$, where $0.09 < 7.81$, meaning that all the research groups are in a homogeneous condition.

Anova Test

The Effect of PBL and PjBL Models on Student Learning Outcomes

There is a difference in the learning outcomes of Class V students at MIS Nurus Salam Deli Tua who were treated with the PBL and PjBL models. This is evidenced by $F_h = 7.55$ and $F_t = 4.09$, and the conclusion is $F_h > F_t$.

Interaction Between Learning Models and Students' Critical Thinking Skills

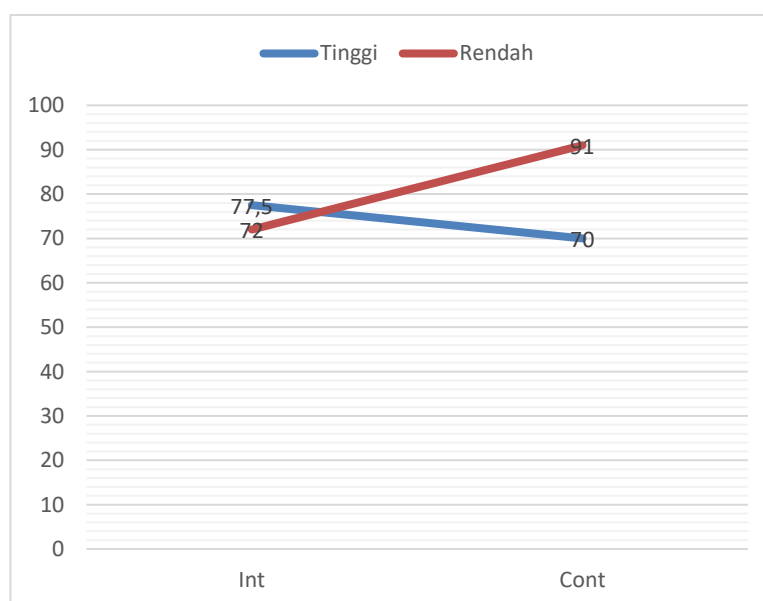
The study's results show that $F_h = 22.07$ and $F_t = 4.09$, and the conclusion is $F_h > F_t$. Therefore, it can be concluded that the learning model interacts with the critical thinking skills of Class V students at MIS Nurus Salam Deli Tua.

Table 7. Average Scores of the Experimental Group

	High	Low
Int	77,5	72
Cont	70	91

Source: Research Data, 2024

Table 7 shows the average scores of the experimental group, with the graph presented in **Picture 1**.



Picture 1. The Graph of the Interaction Between the Learning Model and Students' Critical Thinking Skills.
Source: Research Data, 2024

Tukey Test

Student Learning Outcomes for Those with High Critical Thinking Skills

$$= \frac{77.5 - 72}{\sqrt{\frac{79.51}{40}}} = \frac{5.5}{1.40} = 3.92$$

Students with high critical thinking skills taught using the PjBL model have better learning outcomes than those without high critical thinking skills taught using the PBL model.

$$Q \text{ tabel} = 2 : 20 = 2.81$$

The data analysis was continued with the Tukey test. Based on the calculation results, a significant difference was found because the calculated Q value (Qh) was more significant than the table Q value. The table Q value is 2.81 (Q tabel = 2 : 20), while the calculated Q value is 3.92 (Qh). Therefore, it can be concluded that the learning outcomes of students with high critical thinking skills taught using the PjBL model are better than those of students with high critical thinking skills taught using the PBL model.

Student Learning Outcomes for Those with Low Critical Thinking Skills

$$= \frac{91 - 70}{\sqrt{\frac{79.51}{40}}} = \frac{21}{1.40} = 15$$

$$Q \text{ tabel} = 2 : 20 = 2.81$$

The data analysis was continued with the Tukey test. Based on the calculation results, it was found that there is a significant difference because the table Q value is 2.81 (Q tabel = 2 : 20). The conclusion is that there is a significant difference since the calculated Q value (Qh) is greater than the table Q value. The calculated Q value is 15. Therefore, it can be concluded that the learning outcomes of students with low critical thinking skills taught using the PBL model are better than those of students with low critical thinking skills taught using the PjBL model.

Discussion

Based on the research results, there is a significant difference in the learning outcomes of Grade V students at MIS Nurus Salam Deli Tua who were treated with the PBL and PjBL models. Both models have a positive impact on students' learning outcomes. However, the average learning outcomes indicate that the PjBL model is more effective than the PBL model. According to the provided research, both the PBL and PjBL models have demonstrated effectiveness in enhancing various skills in students. PjBL has been found to improve students' critical thinking skills (Abdullah & Ningrum, 2024; Karlina & Wirdati, 2023), mathematical communication skills (Nurasih *et al.*, 2022), creativity, and achievement in the Indonesian Language Syntax learning material (Ovartadara, 2022). Meanwhile, PBL effectively sharpens critical thinking skills (Stephani, 2017; Karlina & Wirdati, 2023) and improves students' communication skills (Nurasih *et al.*, 2022). Therefore, when comparing the two models, particularly for Civics Education material, it is important to consider the desired objectives and outcomes.

PjBL may excel in fostering creativity and achievement, while PBL may focus more on critical thinking and communication skills. Ultimately, the choice between PjBL and PBL for Civics Education (PKN) material should be based on the specific goals and desired learning outcomes. Other research also recommends that the PjBL model, through various stages of the learning process, can enhance students' roles in the learning process. Students who tend to become bored and disengaged with a learning process that relies only on lectures and monotonous methods become more active in the learning process (Anggraini & Wulandari, 2021). Through PjBL, students are presented with a problem or given a project related to the material, allowing them to work individually or in groups to produce something (Purwanti & Sholihah, 2021; Widiyatmoko & Pamelasari, 2012). Implementing the PjBL model is crucial, considering the still-low level of students' critical thinking skills, to strengthen those critical thinking abilities (Abdullah & Ningrum, 2024; Utaminingtyas, 2020).

PjBL has a significant positive impact on critical thinking skills and learning outcomes among students. Research studies consistently show that implementing the PjBL model improves critical thinking skills, problem-solving ability, literacy, and overall learning outcomes (Karmana, 2023). The PjBL approach encourages students to engage in hands-on projects, collaborate in groups, communicate effectively, and make decisions, all of which are essential components of critical thinking (Awaliyah *et al.*, 2024). PjBL has proven to be significantly effective in enhancing students' critical thinking skills across various educational levels, including for elementary school children (Harianja *et al.*, 2023). Furthermore, PjBL has been found to impact students' critical thinking abilities and emphasizes the importance of student activities in producing practical outcomes while remaining aligned with the curriculum (Rohana *et al.*, 2023). Active student involvement in real-world projects and tasks can enhance cognitive skills, leading to a better understanding of concepts and improved academic performance. Therefore, integrating the PjBL and PBL models in educational settings can be a valuable strategy for fostering critical thinking skills and improving student learning outcomes (Islamiati *et al.*, 2024; Pangesti & Radia, 2021).

CONCLUSION

The PBL and PjBL models influence fifth-grade students' critical thinking skills and learning outcomes at MIS Nurus Salam Deli Tua. The learning outcomes of students with high critical thinking skills taught using the PBL model were better than those with high critical thinking skills taught using the PjBL model. Conversely, the learning outcomes of students with low critical thinking skills taught using the PjBL model were better than those of students with low critical thinking skills taught using the PBL model. There is an interaction between the learning model and the critical thinking skills of fifth-grade students at MIS Nurus Salam Deli Tua. It is recommended that teachers at Islamic or elementary schools (MI/SD) implement

either the PBL or PjBL model. Students are expected to improve their critical thinking skills, positively influencing their learning outcomes. Schools are encouraged to support teachers' instructional activities, including facilitating the implementation of innovative learning models. Future researchers are advised to conduct further studies on the influence of PBL and PjBL models on students' learning outcomes and critical thinking skills.

AUTHOR'S NOTE

The author declares that there is no conflict of interest regarding the publication of this article and confirms that the data and content of the article are free from plagiarism.

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