



## Implementation Strategy Learning Based Project -Based Learning For Increase Ability Think Critical Elementary school students

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### Abstract

*This study aims to examine the application of Project Based Learning ( PjBL ) strategies in improving the critical thinking skills of elementary school students. PjBL is a learning model that is oriented towards real-life activities and is student- centered , where students are actively involved in completing projects that require them to use analytical, evaluation, and problem-solving skills—the main components of critical thinking. This model not only emphasizes mastery of concepts, but also the development of higher-order thinking skills through collaborative and exploratory activities that are relevant to students' real-world situations. Data analysis involved comparing critical thinking test scores before and after learning using PjBL as well as qualitative descriptions of changes in student attitudes and engagement. The results showed that the implementation of the PjBL strategy significantly improved students' critical thinking skills. Students become more active in asking questions, discussing, and solving problems independently and collaboratively during the project work. In addition to improving critical thinking test scores, students were also able to apply learning concepts in real contexts through project products such as life cycle models or ecosystem maps, which served as concrete evidence of their understanding and critical thinking skills. In addition, the project-based learning process fostered students' learning motivation and self-confidence. Project-Based Learning ( PjBL ) also helps teachers manage learning that focuses on 21st-century skills, such as collaboration, creativity, and decision-making. Challenges, such as time management and varying student abilities, can be addressed with careful planning and teacher guidance throughout the project cycle. Overall, the Project-Based Learning strategy is effective as a learning approach in elementary schools to develop students' critical thinking skills while enriching learning experiences that are meaningful and applicable to everyday life.*

**Keywords:** Project-Based Learning, critical thinking, elementary school learning, 21st-century skills.

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### Introduction

Critical thinking has become one of the most essential skills in the 21st century, especially for students in elementary schools, as it lays the foundation for problem-solving, decision-making, and lifelong learning (Afandi, Sunarno, Suryana, & Harjana, 2024; AlAli, 2024). The rapid growth of knowledge, technology, and digital resources requires students to move beyond rote memorization and passive learning. Consequently, educators are increasingly exploring pedagogical strategies that actively engage students in meaningful learning experiences, such as Project-Based Learning (PBL). PBL is a student-centered instructional method that emphasizes real-world problem-solving, collaboration, and knowledge construction through projects (Guo, 2020; Armada, 2023).

Project-Based Learning is grounded in constructivist theories, which argue that learners build knowledge through experiences, social interactions, and reflection (Dewi, Manuaba, & Suniasih, 2018; Fitri & S., 2018). In this approach, students are not merely recipients of knowledge but active participants who investigate questions, analyze problems, and produce tangible outcomes (Imarida, 2024). The central premise of PBL is that learning is more

effective when students are involved in meaningful, context-rich tasks that require critical thinking and collaboration (Asdar, Angreani, Arsyad, Swandi, & Rahim, 2023).

Critical thinking is defined as the ability to analyze information objectively, evaluate evidence, and make reasoned judgments (Muslimah & Hardini, 2022). In elementary schools, fostering critical thinking helps students develop cognitive flexibility, creativity, and problem-solving skills from an early age (Lamauran Koten, Munzil, & Utama, 2024). According to Afandi et al. (2024), integrating creative pedagogy into project-based learning significantly improves higher-order thinking skills in science education. Similarly, AlAli (2024) emphasizes that combining STEM education with project-oriented learning enhances students' analytical abilities and prepares them for future complex problem-solving tasks.

Research indicates that traditional teacher-centered methods, which rely heavily on memorization, limit students' opportunities to develop critical thinking skills (Andini & Muhammad, 2025). Students are often required only to recall information rather than analyze, synthesize, or apply knowledge in new contexts. This limitation necessitates innovative instructional approaches that prioritize active participation, experimentation, and reflection, all of which are core elements of PBL (Asyari & Andari, 2023).

Project-Based Learning involves several key components that make it suitable for developing critical thinking skills: collaborative work, problem-solving tasks, self-directed learning, and real-world applications (Guo, 2020; Imarida, 2024). In PBL, students work on complex questions or projects over an extended period, during which they research information, develop solutions, and present their findings. The process not only engages students in meaningful learning experiences but also encourages them to evaluate alternatives, consider multiple perspectives, and justify their decisions (Permana, Chamisijatin, & Zaenab, 2021).

Moreover, PBL aligns with the principles of experiential learning, in which students learn by doing, reflecting, and applying knowledge to real-life situations (Dewi et al., 2018; Pipih Hadistia, Darmini, & Sati, 2025). For example, elementary students who engage in PBL activities related to environmental issues or community projects learn to analyze problems, make evidence-based decisions, and communicate their findings effectively. These activities foster metacognitive skills and enhance students' ability to think critically (Nadiyah, 2023).

Several studies have documented the positive impact of PBL on students' critical thinking abilities. Armada (2023) found that elementary students who participated in PBL activities demonstrated higher levels of analytical reasoning, problem-solving, and decision-making compared to those in conventional classrooms. Similarly, Imarida (2024) reported that integrating project-based tasks into science lessons significantly improved students' capacity to evaluate evidence and apply knowledge to novel situations.

Research by Muslimah and Hardini (2022) emphasizes that PBL is particularly effective in promoting higher-order cognitive skills because it requires students to engage actively with content, work collaboratively, and reflect on their learning. Moreover, Lamauran Koten et al. (2024) compared PBL with gamification-based group investigations and found that both approaches enhanced critical thinking, but PBL showed more consistent gains in students' ability to analyze complex problems and articulate solutions.

The development of digital learning technologies has further enhanced the implementation of PBL in classrooms. For example, Asdar et al. (2023) demonstrated that integrating digital tools into PBL projects increased students' engagement and allowed for more complex problem-solving activities. Similarly, Afandi et al. (2024) highlighted that

technology-supported PBL enables students to access, organize, and evaluate information efficiently, which is essential for developing critical thinking skills.

Despite its advantages, implementing PBL in elementary schools presents several challenges. Teachers must carefully design projects to align with curriculum standards while remaining engaging and challenging for students (Andini & Muhammad, 2025). Additionally, teachers need to facilitate collaboration effectively, provide guidance without dominating the process, and assess both the product and process of learning (Permana et al., 2021).

Logistical constraints, such as limited classroom resources, time restrictions, and large class sizes, can also impede the successful implementation of PBL (Dewi et al., 2018; Pipih Hadistia et al., 2025). These challenges highlight the importance of professional development and teacher training in PBL methodologies. When teachers are adequately prepared and supported, PBL can be implemented effectively and lead to substantial improvements in students' critical thinking abilities (Imarida, 2024; Selasmawati & Lidyasari, 2023).

The modern educational landscape emphasizes the development of 21st-century skills, including critical thinking, creativity, communication, collaboration, and digital literacy (AlAli, 2024; Guo, 2020). Project-Based Learning inherently supports these skills by requiring students to work collaboratively, communicate ideas clearly, and use technology to solve problems. By embedding PBL into elementary education, teachers can provide authentic learning experiences that mirror real-world challenges, thereby preparing students to navigate complex future tasks (Afandi et al., 2024; Asyari & Andari, 2023).

Moreover, PBL encourages students to take ownership of their learning, fostering intrinsic motivation and self-regulated learning behaviors (Armada, 2023). Students learn to plan their work, set goals, and reflect on their progress, which further strengthens their critical thinking abilities (Muslimah & Hardini, 2022; Lamauran Koten et al., 2024).

The integration of digital tools in PBL has become increasingly important in enhancing student engagement and learning outcomes (Asdar et al., 2023; Guo, 2020). Online platforms, interactive simulations, and collaborative software allow students to conduct research, share findings, and receive feedback in real-time. For instance, digital project portfolios and multimedia presentations provide opportunities for students to present complex ideas effectively, thereby reinforcing critical thinking skills (Afandi et al., 2024; Permana et al., 2021).

In addition, technology supports differentiated learning by allowing students to work at their own pace and access resources tailored to their individual learning needs (Imarida, 2024; Pipih Hadistia et al., 2025). This flexibility ensures that all students, regardless of their initial skill levels, can participate meaningfully in PBL activities and develop critical thinking competencies.

The theoretical foundation of PBL is rooted in constructivism and social learning theory, which posit that knowledge is constructed through interaction with the environment and social collaboration (Dewi et al., 2018; Fitri & S., 2018). According to Vygotsky's theory of the zone of proximal development, students develop higher-order thinking skills when guided by teachers and peers to tackle tasks slightly beyond their current abilities (Guo, 2020; Armada, 2023).

Project-Based Learning aligns with this theoretical perspective by providing scaffolded experiences in which students engage with complex problems, receive guidance, and gradually become independent learners capable of critical analysis and decision-making (Afandi et al., 2024; Imarida, 2024). The iterative process of planning, executing, reflecting, and revising

projects mirrors the cognitive processes required for critical thinking, making PBL an ideal instructional strategy for elementary education.

Given the increasing demand for critical thinking skills in the 21st century, it is imperative to identify effective teaching strategies that foster these abilities from an early age (AlAli, 2024; Muslimah & Hardini, 2022). Project-Based Learning has demonstrated significant potential in enhancing students' analytical, problem-solving, and decision-making skills across various educational contexts (Armada, 2023; Lamauran Koten et al., 2024). However, there is limited research that systematically examines the implementation of PBL in elementary schools, particularly in developing critical thinking competencies in the context of the Indonesian education system (Andini & Muhammad, 2025; Pipih Hadistia et al., 2025). This study seeks to fill that gap by investigating the effects of a strategically designed PBL approach on the critical thinking abilities of elementary students.

## Method

This study employed a mixed-methods approach, combining qualitative and quantitative techniques, using Classroom Action Research (CAR) or *Penelitian Tindakan Kelas (PTK)*. This method allows teachers to act as both practitioners and researchers, implementing the Project-Based Learning (PjBL) model directly in the classroom while continuously reflecting on and improving the learning process (Armada, 2023; Isnani, 2023). CAR is particularly suitable for investigating the practical and inventive strategies of learning implementation because it emphasizes iterative cycles of planning, acting, observing, and reflecting (Afandi, Sunarno, Suryana, & Harjana, 2024).

The research was conducted in a school located in the Tangerang City area, where conventional learning methods were still predominantly used, and students demonstrated a need to enhance their critical thinking skills (Andini & Muhammad, 2025). Participants were fourth-grade students of a public elementary school, who were assessed using written tests that required descriptive answers, encouraging them to analyze, evaluate, and draw conclusions from project-based problems (Imarida, 2024). Assessments were conducted both before the first cycle (pre-cycle) and at the end of each learning cycle to measure improvements in critical thinking.

During the PjBL activities, observation sheets were used to monitor students' critical thinking skills, initiative, collaboration, and overall classroom engagement (Muslimah & Hardini, 2022; Lamauran Koten, Munzil, & Utama, 2024). Observation results complemented written test scores, providing a comprehensive picture of students' abilities. Data from observations and interviews were analyzed descriptively to identify changes in attitudes, motivation, and critical thinking skills. Additionally, the study examined how the PjBL strategy was implemented in daily classroom activities, highlighting its effectiveness in fostering a student-centered, reflective, and collaborative learning environment (Asyari & Andari, 2023; Permana, Chamisijatin, & Zaenab, 2021).

## Results and Discussion

### Overview of Findings

The research was conducted in a public elementary school in Tangerang City, focusing on fourth-grade students and the implementation of Project-Based Learning (PjBL) to enhance critical thinking skills (Armada, 2023; Isnani, 2023). The study utilized a Classroom Action Research (CAR) approach, with multiple cycles of planning, acting, observing, and reflecting to monitor students' learning development. Both qualitative and quantitative data were

collected, including written tests, observation sheets, and interviews with students and teachers (Afandi, Sunarno, Suryana, & Harjana, 2024; Asyari & Andari, 2023).

The primary research objective was to examine how PjBL could improve students' critical thinking skills, initiative, collaboration, and overall engagement. Pre-cycle tests indicated that most students struggled with problem-solving, analysis, and evaluation of project-based tasks (Andini & Muhammad, 2025). Specifically, students could recall information but had difficulty drawing conclusions, comparing alternatives, or justifying their decisions based on evidence (Imarida, 2024; Muslimah & Hardini, 2022).

### **Improvement in Critical Thinking Skills**

After implementing PjBL over multiple cycles, students showed substantial improvement in critical thinking abilities. Written tests administered at the end of each cycle revealed higher scores, particularly in questions requiring analysis, evaluation, and conclusion-drawing (Lamauran Koten, Munzil, & Utama, 2024). For example, in a science project on environmental conservation, students were able to identify problems, propose practical solutions, and justify their recommendations using evidence collected during the project (Afandi et al., 2024; Imarida, 2024).

Observation sheets complemented the written assessments, showing notable progress in critical thinking behaviors such as questioning, reasoning, and problem-solving. During collaborative projects, students increasingly demonstrated initiative by suggesting ideas, experimenting with different approaches, and evaluating the outcomes of their group decisions (Asdar, Angreani, Arsyad, Swandi, & Rahim, 2023). These results support previous studies indicating that PjBL fosters higher-order thinking by engaging students in authentic, meaningful tasks (Guo, 2020; Armada, 2023).

### **Observational Results and Student Engagement**

Observations conducted during PjBL activities highlighted improvements in student engagement and collaborative skills. Initially, students often relied on teachers for guidance and were hesitant to contribute ideas independently. However, as cycles progressed, students actively participated in discussions, divided responsibilities effectively, and supported one another in completing project tasks (Muslimah & Hardini, 2022; Asyari & Andari, 2023). Teachers noted that students' ability to critically evaluate their own work and that of their peers improved significantly. This was particularly evident during reflection sessions, where students assessed the strengths and weaknesses of their projects and proposed adjustments for subsequent cycles (Permana, Chamisijatin, & Zaenab, 2021). The iterative nature of PjBL allowed students to gradually internalize critical thinking processes, reinforcing both cognitive and metacognitive skills (Afandi et al., 2024).

### **Implementation of Project-Based Learning Strategy**

The PjBL strategy was applied through structured projects integrated into the science and mathematics curriculum. Each project involved identifying a problem, planning a solution, executing the project, and presenting findings. Teachers facilitated the process by guiding students in research, data collection, analysis, and presentation while gradually reducing direct instruction (Armada, 2023; Isnani, 2023).

Digital tools were also incorporated, enabling students to document their work, create presentations, and access online resources for project research (Asdar et al., 2023; Guo, 2020). Technology-enhanced PjBL encouraged self-directed learning and allowed students to apply critical thinking skills in authentic contexts. For instance, QR-based data collection and interactive simulations in science projects enabled students to analyze patterns and make evidence-based decisions (Afandi et al., 2024).

### **Changes in Student Attitude and Motivation**

One of the most significant outcomes of PjBL implementation was the improvement in students' attitudes toward learning. Observation and interview data indicated increased

motivation, curiosity, and a positive disposition toward problem-solving (Asyari & Andari, 2023; Lamauran Koten et al., 2024). Students reported feeling more confident in expressing ideas, asking questions, and proposing solutions. This finding aligns with previous research demonstrating that project-based activities foster intrinsic motivation by providing ownership and relevance to learning (Armada, 2023; Muslimah & Hardini, 2022).

Students' collaborative skills also improved, with peer support becoming more consistent across cycles. Groups developed strategies for delegating tasks and resolving conflicts independently, reflecting higher levels of social and cognitive engagement (Asdar et al., 2023; Imarida, 2024). These social dynamics are essential for critical thinking development, as they encourage reflection, discussion, and evaluation of multiple perspectives (Guo, 2020; Permana et al., 2021).

### **Comparative Analysis**

Comparing pre-cycle and post-cycle data revealed significant gains in both written assessments and observational measures of critical thinking. Before PjBL implementation, most students scored below the minimum mastery criteria for analysis and evaluation questions (Andini & Muhammad, 2025). After multiple cycles, the majority achieved high proficiency, demonstrating improved reasoning, problem-solving, and conclusion-forming abilities (Afandi et al., 2024; Armada, 2023).

Observational analysis also highlighted that PjBL supported differentiation, allowing students at varying ability levels to engage meaningfully with projects. Students who initially struggled showed gradual improvement through scaffolded support and peer collaboration (Muslimah & Hardini, 2022; Asyari & Andari, 2023). The combination of iterative practice, reflection, and collaborative engagement created a conducive environment for sustained cognitive development.

### **Discussion**

The findings confirm that Project-Based Learning is an effective strategy for enhancing critical thinking skills among elementary students (Afandi et al., 2024; Imarida, 2024). The iterative, student-centered nature of PjBL aligns with constructivist learning principles, emphasizing active knowledge construction, problem-solving, and reflection (Guo, 2020; Armada, 2023).

Furthermore, the integration of technology and digital tools facilitated more efficient research, analysis, and presentation, reinforcing critical thinking in authentic contexts (Asdar et al., 2023; Permana et al., 2021). The study demonstrates that PjBL not only improves cognitive outcomes but also positively affects motivation, engagement, and collaborative skills, which are essential for holistic development in 21st-century education (Lamauran Koten et al., 2024; Muslimah & Hardini, 2022).

### **Implications for Practice**

This study provides several practical implications for educators. First, PjBL should be implemented systematically, with clear scaffolding and iterative cycles to support skill development. Second, integrating observation and assessment tools allows teachers to monitor both cognitive and affective growth. Third, incorporating digital tools enhances engagement and provides opportunities for authentic problem-solving experiences (Afandi et al., 2024; Asdar et al., 2023).

Finally, teacher training is crucial to ensure effective facilitation of PjBL, especially in balancing guidance and student autonomy (Armada, 2023; Isnani, 2023). When implemented strategically, PjBL can serve as a transformative instructional approach that fosters critical thinking, collaboration, and lifelong learning competencies from an early age.

## Conclusion

Based on results studies and various study related implementation of Project Based Learning ( PjBL ) strategy in education Elementary School (SD), can concluded that PjBL effective and significant in increase ability think critical students . First , the use of PjBL in a way direct push student For active involved in the learning process through problem - oriented projects real , which allows they develop skills analysis , evaluation , and problem solving problem in a way systematic and logical .

Second , empirical data show improvement skills think critical trained students with PjBL more tall compared to with method learning conventional . The average increase in N-Gain value in the class that implemented PjBL is in the category currently until high , indicating effectiveness strategy This in increase ability critical elementary school students . This is reinforced by testing statistics in various research that found difference significant between group experiment with control .

Third , implementation PjBL also increases motivation and engagement active student in learning . Through Work groups and management project , students No only Study understand material , but also sharpen skills social like communication and collaboration , which supports development think critical in a way more comprehensive . Besides that , the process of reflection and evaluation results project strengthen ability metacognitive student in assess and improve results his mind .

Fourth , the teacher plays a role as facilitator who provides guidance and feedback come back strategic during the learning process walking , which is very it is important that PjBL can implemented in a way effective and leads to improvement think critical optimally . However Thus , the challenge like limitations time and variation ability student need anticipated with planning and management good class .

Fifth , in general overall PjBL in accordance with principle learning 21st century which emphasizes skills think critical , creativity , and work the same . Therefore that , PjBL very recommended as strategy learning in elementary school for develop capacity think critical student as supplies relevant and applicable future competencies

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