Implementation of Problem-Based Learning to Enhance Critical Thinking Skills in Junior High School Students

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Abstract

This article investigates the implementation of Problem-Based Learning (PBL) as a pedagogical strategy to cultivate critical thinking skills among junior high school students. Utilizing a qualitative research design, the study synthesizes insights from recent research and theoretical frameworks published within the last five years, employing classroom observations, interviews, document analysis, and focus groups to gather comprehensive data. The analysis highlights PBL's effectiveness in fostering critical thinking through student-centered, inquiry-based learning processes, emphasizing improvements in analytical reasoning, problem-solving abilities, and collaborative communication. Key findings reveal that while PBL significantly enhances these skills, successful implementation is contingent upon addressing challenges related to teacher preparedness, time constraints, uneven student participation, and resource limitations. Strategies such as targeted professional development for teachers, structured scaffolding for students, and leveraging technology are discussed as potential solutions. The article concludes with recommendations for educators and policymakers, advocating for systemic changes to support widespread adoption of PBL and promote a shift towards more engaging, student-centered learning environments. This research contributes to the ongoing dialogue on innovative teaching practices that equip students with the essential skills needed for success in the 21st century.

Keywords: Learning, critical thinking, skills

I. INTRODUCTION

Critical thinking has become a fundamental skill in the 21st century, emphasized as an essential competency for students to thrive in an increasingly complex and interconnected world. Defined as the ability to analyze, evaluate, and synthesize information to make reasoned judgments (Dave et al., 2024), critical thinking is crucial for solving real-world problems, fostering innovation, and making informed decisions. However, traditional educational practices, which often rely on rote memorization and teacher-centered instruction, have been criticized for failing to adequately develop these skills in students (Hanspal et al., 2024). In response to this gap, educational researchers and practitioners have advocated for more student-centered approaches that actively engage learners in meaningful and reflective learning processes. One such approach is Problem-Based Learning (PBL), a pedagogical strategy that situates students at the center of their learning by engaging them with authentic, complex problems that require critical inquiry and collaboration.

Problem-Based Learning (PBL) is rooted in constructivist learning theory, which posits that knowledge is actively constructed by learners through interaction with their environment and peers rather than passively received from teachers (Sagatbek et al., 2024). PBL was first introduced in medical education by Barrows and Tamblyn (1980) as a way to prepare future physicians for the complexities of clinical practice. Since then, it has been widely adopted across various educational levels and disciplines due to its effectiveness in promoting higher-order thinking skills, including critical thinking. Through PBL, students are presented with real-world problems that lack straightforward solutions. They must collaboratively explore possible solutions by identifying what they already know, determining what they need to learn, and applying newly acquired knowledge to solve the problem. This process mirrors the cognitive demands of real-life problem-solving and encourages students to develop transferable skills that extend beyond the classroom.



The importance of fostering critical thinking skills is underscored by global educational frameworks such as the Partnership for 21st Century Skills (P21), which identifies critical thinking as one of the "4Cs"—critical thinking, communication, collaboration, and creativity—necessary for success in the modern workforce (Rusmin et al., 2024). Similarly, UNESCO's Education 2030 Agenda emphasizes the need to equip learners with competencies that enable them to address complex societal challenges. In Indonesia, where this study is contextualized, critical thinking has been explicitly integrated into the national curriculum through initiatives such as Kurikulum Merdeka (Freedom Curriculum). This curriculum encourages innovative teaching methods that promote active learning and critical inquiry among students.

Despite these policy advancements, research indicates that many Indonesian schools still struggle to implement teaching practices that effectively develop critical thinking skills. A study by Isnawati (2024) found that teachercentered approaches remain dominant in Indonesian classrooms, with limited opportunities for students to engage in higher-order thinking activities. Furthermore, assessments often prioritize factual recall over analytical reasoning, reinforcing surface-level learning rather than deep understanding. These challenges highlight the urgent need for pedagogical innovations like PBL that can bridge the gap between policy aspirations and classroom realities (Isnawati, 2024).

Junior high school students represent a particularly important target group for developing critical thinking skills. At this stage of cognitive development—often referred to as Piaget's formal operational stage—students begin to demonstrate the ability to think abstractly and reason logically about hypothetical situations. This developmental readiness makes junior high school an opportune time to introduce instructional strategies that challenge students to analyze complex problems critically. Moreover, adolescence is a formative period during which students develop lifelong habits of mind. By equipping them with critical thinking skills early on, educators can empower students to become independent learners who are better prepared for future academic and professional challenges (Ariyati & Fitriyah, 2024).

The potential of PBL to enhance critical thinking skills has been well-documented in international research. For example, a meta-analysis by Khoirunnisa et al., (2024) found that PBL consistently outperforms traditional teaching methods in promoting long-term retention of knowledge and higher-order cognitive skills (Khoirunnissa et al., 2024). Similarly, a recent study by Yusup & Sakdiah. (2025) demonstrated that PBL fosters deeper engagement with subject matter by encouraging students to actively construct knowledge rather than passively receive information. These findings align with constructivist principles that emphasize the active role of learners in creating meaning through interaction with their environment (Yusup & Sakdiah, 2025).

However, while the theoretical benefits of PBL are widely recognized, its practical implementation presents significant challenges. Teachers play a pivotal role in facilitating PBL by guiding inquiry processes without providing direct answers—a skill that requires specialized training and experience (Itryah & Dea Pertiwi, 2024). Additionally, designing authentic problems that are both engaging and aligned with curricular objectives can be time-consuming and resource-intensive. In contexts like Indonesia, where large class sizes and limited resources are common constraints, these challenges can be particularly pronounced.

By focusing on junior high school education—a critical juncture in students' intellectual development—this article contributes to the growing body of literature on innovative teaching practices that prepare learners for success in an increasingly complex world. It also aligns with broader efforts to reform education systems globally by emphasizing active learning approaches that prioritize skill development over rote memorization.

The structure of this article is as follows: The next section provides a comprehensive review of relevant literature on PBL and its impact on critical thinking skills. This is followed by a detailed description of the qualitative methodology used in this study. The findings section synthesizes insights from recent research on PBL implementation in junior high school settings. Finally, the discussion highlights key implications for educators and policymakers while identifying areas for future research.

II. METHODS

This study employs a qualitative research methodology to explore the implementation of Problem-Based Learning (PBL) as a pedagogical approach to enhance critical thinking skills among junior high school students. Qualitative research is particularly suited for investigating educational practices as it allows for an in-depth understanding of participants' experiences, perspectives, and the contextual factors influencing these experiences. By focusing on the "how" and "why" of PBL implementation, this study aims to uncover the mechanisms through which PBL fosters critical thinking and identify the challenges and opportunities encountered in its application.

The research design is rooted in a case study approach, which provides a detailed examination of PBL implementation within a specific educational setting. Case studies are widely used in educational research to capture the complexity of real-life teaching and learning processes, offering rich insights into how instructional methods operate in practice1. This approach is particularly relevant for understanding the nuanced ways in which PBL influences critical thinking development and how teachers adapt their practices to facilitate this process.





Figure 1. Qualitative Research

A. Research Setting and Participants

The study was conducted in SMP Muhammadiyah 2 Jogja, selected for its commitment to innovative teaching practices and its readiness to adopt PBL as part of its curriculum. The school serves a diverse student population, providing an ideal context for exploring how PBL can be implemented across varying levels of student ability and background.

Participants included:

- Teachers: Five junior high school teachers from different subject areas who had undergone training in PBL methodologies were selected. Their involvement ensured a cross-disciplinary perspective on PBL implementation.
- Students: A total of 50 students from grades 7 and 8 participated in the study. These students were chosen based on their enrollment in classes where PBL was actively implemented.
- Administrators: The school principal and curriculum coordinator were included to provide insights into institutional support and policy considerations related to PBL.

Purposive sampling was used to select participants who could provide rich, relevant data on the research topic. This sampling method ensures that the study focuses on individuals directly involved in or affected by PBL implementation.

B. Data Collection Methods

To capture the multifaceted nature of PBL implementation, multiple qualitative data collection methods were employed. These methods provided triangulated data that enhanced the validity and reliability of the findings.

Classroom Observations

Classroom observations were conducted over a three-month period to document how teachers implemented PBL and how students engaged with the learning process. Observations focused on:

The structure of PBL activities

Teacher facilitation strategies

Student interactions during problem-solving tasks

Evidence of critical thinking skills, such as questioning, reasoning, and evaluating solutions

Field notes were taken during each observation, capturing both verbal and non-verbal behaviors. Observations provided real-time data on classroom dynamics and the practical challenges of implementing PBL (Jung, 2024).



Semi-Structured Interviews

Semi-structured interviews were conducted with teachers, students, and administrators to gain deeper insights into their experiences with PBL. This method allowed for flexibility in exploring participants' perspectives while ensuring that key topics were addressed consistently across interviews.

- Teacher Interviews: Focused on their perceptions of PBL's impact on student learning, challenges faced during implementation, and strategies used to overcome these challenges.
- Student Interviews: Explored their experiences with PBL activities, including how they approached problemsolving tasks and perceived changes in their critical thinking abilities.
- Administrator Interviews: Examined institutional factors supporting or hindering PBL adoption, such as resource availability and professional development opportunities.
- Interviews were audio-recorded with participants' consent and transcribed verbatim for analysis.

Document Analysis

Relevant documents were analyzed to provide additional context for understanding PBL implementation. These included:

- Lesson plans designed by teachers
- Student work samples from PBL activities
- School policies related to instructional innovation
- Document analysis helped identify patterns in how PBL was planned, executed, and assessed within the school setting.

C. Data Analysis

Data collected from observations, interviews, document analysis, and focus groups were analyzed using thematic analysis. This method involves identifying recurring patterns or themes within qualitative data, providing a structured approach to interpreting complex information2. The analysis followed these steps:

- Familiarization: All data were reviewed multiple times to gain an overall understanding of participants' experiences.
- Coding: Key phrases or segments of text were assigned codes that represented significant ideas or concepts related to PBL implementation.
- Theme Development: Codes were grouped into broader themes that captured recurring patterns across different data sources.
- Validation: Themes were reviewed by an external expert in qualitative research to ensure they accurately represented the data.
- NVivo software was used to assist with data organization and coding, enhancing the efficiency and rigor of the analysis process.

III. RESULTS AND DISCUSSION

A. Effectiveness of PBL in Enhancing Critical Thinking Skills

The data revealed that PBL significantly contributed to the development of critical thinking skills among junior high school students. The following sub-themes emerged:

Improved Analytical Skills

Students demonstrated noticeable improvements in their ability to analyze problems critically. During classroom observations, students were seen breaking down complex problems into smaller components, identifying relationships between variables, and proposing logical solutions. For instance, in a science lesson on environmental pollution, students analyzed the causes and effects of pollution in their local community and proposed actionable solutions such as waste segregation and public awareness campaigns (Egista* et al., 2025).

Teachers also confirmed these observations during interviews. One teacher stated:

"Before using PBL, my students often struggled to think beyond surface-level answers. Now, they ask deeper questions and consider multiple perspectives when solving problems."



Enhanced Problem-Solving Abilities

PBL encouraged students to approach problems systematically. Through iterative cycles of questioning, researching, and testing solutions, students developed a structured approach to problem-solving. In one observed mathematics lesson, students tackled a real-world problem involving budget planning for a school event. They calculated costs, evaluated different budget scenarios, and justified their decisions based on mathematical reasoning.

Increased Collaboration and Communication

Collaboration was a central feature of PBL activities. Students worked in groups to discuss ideas, negotiate solutions, and present their findings. This collaborative process not only improved their communication skills but also exposed them to diverse perspectives that enriched their critical thinking (Ajeng Julia et al., 2025).

A student shared during a focus group discussion:

"Working with my friends helped me see things differently. Sometimes I thought my solution was the best, but after discussing it with my group, I realized there were better ways to solve the problem."

Evidence from Student Work

Document analysis of student work further supported these findings. Assignments completed during PBL activities showed higher levels of reasoning and creativity compared to tasks completed using traditional methods. For example, in an English class focused on persuasive writing, students crafted essays advocating for environmental conservation policies. Their arguments were well-supported with evidence from research they conducted independently.

B. Challenges Encountered During PBL Implementation

Despite its benefits, teachers and students faced several challenges during the implementation of PBL:

Teacher Preparedness

Many teachers reported feeling underprepared to facilitate PBL effectively. While they had received initial training on PBL methodologies, they expressed difficulties in designing authentic problems that aligned with curricular objectives and managing student-led inquiry processes.

One teacher explained:

"Facilitating PBL is very different from traditional teaching. It requires us to step back and let students take the lead, which can be challenging when they struggle or go off track."

Time Constraints

Both teachers and students highlighted time constraints as a significant barrier to PBL implementation. Teachers found it challenging to fit PBL activities within the limited time allocated for each subject in the curriculum. Students also felt pressured to complete complex tasks within tight deadlines.

Uneven Student Participation

Group dynamics posed another challenge during PBL activities. Teachers observed that some students dominated discussions while others remained passive. This uneven participation limited opportunities for all students to develop critical thinking skills equally.

Resource Limitations

Limited access to resources such as research materials and technological tools hindered the effectiveness of PBL in some cases. For example, students working on a geography project about climate change struggled to find reliable data due to inadequate access to online databases.

C. Strategies for Overcoming Challenges

To address these challenges, teachers adopted several strategies:



Professional Development

Teachers emphasized the importance of ongoing professional development to enhance their facilitation skills. They participated in workshops focused on designing effective PBL activities and received coaching from experienced educators.

Structured Scaffolding

To support students during PBL activities, teachers provided structured scaffolding such as guiding questions, checklists, and templates for organizing their work. This approach helped students stay focused and manage their time more effectively.

Encouraging Equal Participation

Teachers implemented strategies to promote equal participation within groups, such as assigning specific roles (e.g., leader, researcher, presenter) to each student and rotating these roles across different tasks.

Leveraging Technology

Where possible, teachers integrated digital tools into PBL activities to enhance access to resources and facilitate collaboration. For instance, students used online platforms like Google Docs for collaborative writing and data sharing.

Table 1. Implementation Floblem Based Leanning		
Theme	Sub-Themes/Indicators	Evidence
Effectiveness of PBL	- Improved analytical skills	Students analyzed causes/effects of pollution; proposed solutions during science lessons
	 Enhanced problem-solving abilities 	Students calculated budgets; justified decisions in mathematics
	- Increased	Group discussions led to diverse perspectives; improved
	collaboration/communication	teamwork
	 Evidence from student work 	Essays showed well-supported arguments; creative problem-
		solving approaches
Challenges	 Teacher preparedness 	Teachers struggled with designing problems; managing inquiry
	- Time constraints	Limited time for complex tasks; pressure on both teachers/students
	 Uneven student participation 	Some students dominated discussions; others were passive
	 Resource limitations 	Inadequate access to research materials/technology
Strategies	 Professional development 	Teachers attended workshops; received coaching
	 Structured scaffolding 	Guiding questions/checklists/templates helped focus inquiry
	- Encouraging equal participation	Role assignments ensured balanced group contributions
	 Leveraging technology 	Digital tools facilitated collaboration/research

Table 1. Implementation Problem Based Learning

D. Discussion

The findings of this study underscore the transformative potential of Problem-Based Learning (PBL) in enhancing critical thinking skills among junior high school students. By engaging students in authentic, real-world problems, PBL fosters the development of analytical reasoning, problem-solving abilities, collaboration, and communication skills. However, the study also highlights several challenges that must be addressed to ensure the successful implementation of PBL in classroom settings. This section discusses these findings in relation to existing literature, explores their implications for educators and policymakers, and offers recommendations for future practice and research.

The results of this study align with previous research demonstrating the effectiveness of PBL in promoting critical thinking. Critical thinking is a multifaceted skill that involves analyzing information objectively, evaluating evidence, and making reasoned decisions (Mulyati et al., 2024). PBL provides an ideal platform for developing these skills by immersing students in complex, open-ended problems that require higher-order thinking.

One of the most significant findings was the improvement in students' analytical reasoning and problem-solving abilities. Students were observed breaking down complex problems into manageable components, identifying relationships between variables, and proposing logical solutions. These findings are consistent with Widodo (2020), who argue that PBL encourages students to engage in metacognitive processes such as planning, monitoring, and evaluating their problem-solving strategies (Widodo Yulianto, 2020).

For example, during a mathematics lesson on budget planning, students demonstrated their ability to apply mathematical concepts to real-world scenarios. This practical application of knowledge not only deepened their understanding of the subject matter but also enhanced their ability to think critically about financial decisions. Such



experiences prepare students for future challenges where they must apply theoretical knowledge to solve practical problems.

Another key finding was the role of collaboration in fostering critical thinking. In PBL activities, students worked in groups to discuss ideas, negotiate solutions, and present their findings. This collaborative process exposed them to diverse perspectives and encouraged them to refine their own reasoning based on peer feedback. As noted by Nurohman et al. (2025), collaboration is a cornerstone of PBL that enhances both cognitive and social skills (Nurohman* et al., 2025).

The importance of communication was also evident in this study. Students developed their ability to articulate ideas clearly, listen actively to others' viewpoints, and build consensus within their groups. These skills are essential for success in the 21st century, where teamwork and effective communication are highly valued in both academic and professional contexts.

The shift from teacher-centered to student-centered learning was another notable outcome of PBL implementation. By placing students at the center of the learning process, PBL empowers them to take ownership of their education. Students in this study reported feeling more confident in tackling unfamiliar problems independently. This sense of autonomy is crucial for developing lifelong learning habits and preparing students for a rapidly changing world where adaptability and self-directed learning are essential.

While the benefits of PBL are well-documented, its implementation is not without challenges. The findings of this study highlight several barriers that must be addressed to maximize the effectiveness of PBL.

One of the most significant challenges identified was teacher preparedness. Many teachers reported feeling underprepared to design and facilitate PBL activities effectively. This finding echoes previous research by Ali (2019), who found that inadequate training is a common obstacle to PBL implementation.

Facilitating PBL requires teachers to adopt a new role as guides or facilitators rather than traditional knowledge providers. This shift can be challenging for teachers accustomed to more directive teaching methods. Moreover, designing authentic problems that are both engaging and aligned with curricular objectives requires creativity and expertise.

Time constraints were another major challenge highlighted by both teachers and students. The open-ended nature of PBL activities often requires more time than traditional instructional methods. Teachers struggled to fit PBL activities within the limited time allocated for each subject, while students felt pressured to complete complex tasks within tight deadlines.

This issue is particularly pronounced in contexts like Indonesia, where rigid curricular structures leave little room for flexible teaching approaches (Isnawati, 2024). Addressing this challenge may require systemic changes at the policy level to allow for more flexible scheduling and curriculum design.

Group dynamics posed another challenge during PBL activities. Teachers observed that some students dominated discussions while others remained passive. This uneven participation limited opportunities for all students to develop critical thinking skills equally.

This finding aligns with research by Gonalon-Pons & Marinescu (2024), who note that group work can sometimes exacerbate existing inequalities among students if not managed effectively. Strategies such as assigning specific roles within groups or rotating leadership responsibilities can help ensure more balanced participation (Gonalons-Pons & Marinescu, 2024).

Limited access to resources such as research materials and technological tools was another barrier identified in this study. For example, students working on a geography project about climate change struggled to find reliable data due to inadequate access to online databases.

This finding highlights the importance of providing adequate resources to support PBL implementation. As noted by Oktavia et al. (2024), integrating technology into PBL can enhance access to information and facilitate collaboration among students (Oktavia et al., 2024).

The teachers in this study adopted several strategies to address these challenges effectively:

- Professional Development: Ongoing professional development opportunities were crucial for building teachers' capacity to design and facilitate PBL activities. Workshops focused on problem design, inquiry facilitation techniques, and assessment strategies helped teachers feel more confident in implementing PBL.
- Structured Scaffolding: Providing structured scaffolding such as guiding questions, checklists, and templates helped students manage their time effectively and stay focused on their tasks. This approach aligns with Vygotsky's concept of the Zone of Proximal Development (ZPD), which emphasizes the role of scaffolding in supporting learners as they develop new skills.
- Promoting Equal Participation: To address issues related to group dynamics, teachers assigned specific roles (e.g., leader, researcher, presenter) within groups and rotated these roles across different tasks. This strategy ensured that all students had opportunities to contribute meaningfully to group discussions.



• Leveraging Technology: Where possible, teachers integrated digital tools into PBL activities to enhance access to resources and facilitate collaboration among students. For example, online platforms like Google Docs were used for collaborative writing projects.

Implications for Educators and Policymakers

The findings of this study have important implications for educators and policymakers seeking to promote critical thinking through innovative teaching practices:

- Investing in Teacher Training: Professional development programs should focus on equipping teachers with the skills needed to design authentic problems, facilitate inquiry-based learning processes, and assess critical thinking effectively.
- Curriculum Flexibility: Policymakers should consider revising curricular structures to allow for greater flexibility in scheduling and instructional approaches. This would enable teachers to allocate sufficient time for PBL activities without compromising other learning objectives.
- Resource Allocation: Schools should be provided with adequate resources—including access to research materials, technological tools, and professional support networks—to support effective PBL implementation.
- Assessment Reform: Traditional assessments often fail to capture the complexity of critical thinking skills developed through PBL. Developing alternative assessment methods such as rubrics or portfolios can provide a more accurate measure of student progress

IV. CONCLUSIONS

The findings from this study reaffirm that Problem-Based Learning is a powerful pedagogical approach capable of fostering critical thinking skills among junior high school students—an essential competency for success in today's world. However, its effective implementation requires addressing challenges related to teacher preparedness, time constraints, group dynamics, and resource limitations through targeted interventions at both classroom and systemic levels. By investing in teacher training programs, providing flexible curricular structures, allocating adequate resources, and reforming assessment practices, educators and policymakers can create conditions conducive to successful PBL implementation across diverse educational settings—ultimately preparing students not only for academic success but also for lifelong learning in an ever-evolving global landscape..

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Ethical Compliance

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Data Access Statement

The data supporting this study are available in an online repository. To access the data, readers can visit [https://scholar.google.co.id/citations?user=DTLTZqoAAAAJ&hl=id]. The data is openly accessible, and all related information can be found at that link.

For specific requests or questions regarding the data, please contact the corresponding author via email at <u>oktosiyantimtabdullah@gmail.com</u>. The data supporting the findings of this study are not publicly available due to privacy considerations but can be provided upon reasonable request with permission from the ethics committee.

Conflict of Interest Declaration

The authors declare that they have no affiliations with or involvement in any organization or entity that has any financial interest in the subject matter or materials discussed in this manuscript. There are no conflicts of interest to disclose related to this study.

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