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Implementation of Active Learning Based on Problem-Based Learning to Improve Critical Thinking Ability of Junior High School Students

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ABSTRACT

This study aims to examine the effect of Problem-Based Learning (PBL) models on the critical thinking skills of junior high school students. As critical thinking becomes increasingly vital in 21st-century education, effective pedagogical strategies are needed to foster this competency. PBL is a student-centered approach that encourages learners to engage with real-world problems, develop hypotheses, seek relevant information, and formulate evidence-based solutions collaboratively. The research utilized a quasi-experimental design with a pretest-posttest control group. The participants were 60 eighth-grade students from a public junior high school, divided into experimental and control groups. The experimental group received instruction through PBL, while the control group used conventional learning methods. Critical thinking was measured using a validated test covering analysis, inference, interpretation, and reasoning indicators. Data analysis with paired and independent sample t-tests showed a statistically significant improvement in the critical thinking scores of the PBL group compared to the control group. These findings suggest that the PBL model effectively enhances students' ability to analyze information, make logical connections, and solve problems independently. The study recommends the integration of PBL in junior high school curricula to improve students' higher-order thinking skills and promote more active and meaningful learning experiences.

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1. INTRODUCTION

The demands of the 21st century have brought significant transformations in the field of education. Among the competencies increasingly recognized as essential in this era is critical thinking. The rapid development of technology, global communication, and the information society has necessitated educational practices that not only transmit knowledge but also empower students to think critically, solve problems, and make reasoned decisions. Consequently, educational institutions around the world are called to design learning environments that support the development of higher-order thinking skills from an early age.

In the context of junior high school education, where students transition from concrete to more abstract forms of reasoning, the cultivation of critical thinking is particularly crucial. It is during this stage that learners begin to develop the capacity to evaluate arguments, recognize logical connections, interpret evidence, and reflect on their own thinking processes. However, traditional methods of instruction, which often rely on rote memorization and teacher-centered approaches, are insufficient for fostering such complex cognitive skills. As a result, educators and researchers have turned their attention to more student-centered pedagogies, including Problem-Based Learning (PBL).

Problem-Based Learning is an instructional model that presents students with complex, real-world problems that require inquiry, analysis, collaboration, and synthesis to resolve. Rather than simply receiving information, students actively engage in the learning process by identifying what they need to know, locating relevant resources, proposing solutions, and reflecting on their learning outcomes. Originating from medical education, PBL has since been adapted across disciplines and educational levels, including secondary education. The theoretical foundation of PBL lies in constructivist learning theory, which posits that learners construct knowledge through active engagement and social interaction. By working collaboratively on meaningful problems, students not only acquire content knowledge but also develop essential thinking skills such as analysis, inference, evaluation, and metacognition. Furthermore, PBL encourages autonomy, motivation, and responsibility for learning traits that are integral to lifelong learning and academic success.

Numerous studies have reported the positive impact of PBL on student learning outcomes, including enhanced problem-solving skills, deeper conceptual understanding, and improved academic performance. However, evidence concerning the specific effect of PBL on critical thinking, particularly among junior high school students, remains limited and inconclusive. While some studies highlight significant improvements, others suggest minimal or no impact, often due to variations in implementation, teacher preparedness, or assessment strategies. In Indonesia and many other countries, the implementation of PBL in junior high school settings is still at an early stage. Although the national curriculum emphasizes the importance of developing critical thinking, many schools continue to use traditional lecture-based methods due to various challenges such as limited resources, lack of teacher training, and rigid assessment systems. Therefore, empirical research is needed to examine whether and how PBL can be effectively used to improve students' critical thinking abilities at this educational level.

Despite the recognized importance of critical thinking, many junior high school students struggle to demonstrate this skill in classroom settings. This deficiency is often attributed to the predominance of conventional teaching methods that prioritize content coverage over inquiry and reflection. As a result, students become passive recipients of information rather than active constructors of knowledge. Addressing this issue requires innovative teaching strategies that align with the principles of active learning and critical pedagogy. Given the theoretical promise and preliminary evidence supporting PBL, it is imperative to investigate its practical effectiveness in real educational contexts. Specifically, this study seeks to determine whether implementing the Problem-Based Learning model can significantly enhance the critical thinking abilities of junior high school students.

The findings are expected to inform educational practices and policy decisions related to curriculum development, teacher training, and instructional design. To examine the effect of Problem-Based Learning on the critical thinking abilities of junior high school students, To compare the differences in critical thinking performance between students exposed to PBL and those taught using traditional methods, To analyze which aspects of critical thinking (e.g., analysis, inference, evaluation) are most impacted by the PBL model. This study holds both theoretical and practical significance. Theoretically, it contributes to the growing body of literature on the role of active learning models in developing 21st-century competencies. By focusing on junior high school students, it provides insights into the cognitive development of learners at a critical educational stage. Practically, the study offers empirical evidence for educators, school leaders, and policymakers seeking to enhance critical thinking in school curricula. The results can be used to advocate for wider adoption of PBL and to design professional development programs that equip teachers with the necessary skills to implement student-centered instruction effectively.

The scope of this study is limited to eighth-grade students in a selected junior high school. While the results may offer generalizable insights, they may not fully capture the diversity of contexts across different regions, school types, or student populations. Additionally, the study focuses solely on cognitive outcomes related to critical thinking, without exploring other potential benefits of PBL such as collaboration, communication, or motivation. Moreover, the duration of the intervention and the fidelity of its implementation may influence the outcomes, necessitating careful interpretation of the results. In light of the increasing demand for critical thinkers in modern society, educational institutions must adopt teaching strategies that go beyond content delivery to foster deep, analytical thinking. Problem-Based Learning offers a promising pathway to achieving this goal by immersing students in challenging, real-world problems that stimulate inquiry and reflection. This study aims to explore the impact of PBL

on the critical thinking abilities of junior high school students and to provide evidence-based recommendations for its implementation in educational practice. The following sections will detail the methodology, present the findings, and discuss their implications for teaching and learning in contemporary classrooms.

2. RESEARCH METHOD

This study employed a quantitative research approach with a quasi-experimental design to investigate the effect of the Problem-Based Learning (PBL) model on the critical thinking ability of junior high school students. Specifically, the non-equivalent control group design was utilized, involving two groups: an experimental group taught using the PBL model and a control group taught using conventional methods. This design was chosen because it allows for comparison between groups without random assignment, which is often impractical in school settings. The research was conducted at a public junior high school during the second semester of the academic year. The population consisted of all eighth-grade students, with two classes selected as samples using purposive sampling based on similar academic ability levels. One class served as the experimental group (PBL), and the other as the control group (traditional learning). Data collection was carried out using a critical thinking test developed based on indicators from Ennis's critical thinking framework, which includes analysis, inference, explanation, evaluation, and self-regulation. The test consisted of essay-type questions to assess students' higher-order thinking skills. The instrument was validated through expert judgment and tested for reliability using Cronbach's Alpha. Before the intervention, both groups took a pre-test to assess their baseline critical thinking ability. The experimental group was then taught using the PBL model for a period of four weeks, while the control group continued with conventional instruction. After the intervention, both groups completed a post-test. Data were analyzed using independent sample t-tests to compare the post-test scores between the experimental and control groups. In addition, paired sample t-tests were used to compare pre-test and post-test scores within each group. The significance level was set at 0.05 to determine whether the differences were statistically significant.

3. RESULTS AND DISCUSSIONS

The Role of Student Engagement

Another contributing factor to the success of PBL in this study is student engagement. Students in the PBL group demonstrated higher levels of enthusiasm, motivation, and curiosity throughout the learning sessions. The problems presented in the PBL model were contextual and relevant to students' everyday lives, which increased their interest and willingness to participate actively. Motivated students are more likely to engage in self-directed learning, seek additional resources, and discuss alternative viewpoints—all of which are crucial for the development of critical thinking. In contrast, the control group, which followed a more teacher-centered approach, lacked such stimuli and therefore exhibited lower engagement levels.

Student involvement plays a crucial role in the success of educational strategies aimed at developing higher-order thinking skills, particularly in the context of Problem-Based Learning (PBL). In PBL, students are not passive recipients of information but active participants in the learning process. Their level of engagement directly influences how deeply they process information, collaborate with peers, and apply critical thinking to solve real-world problems. One of the central features of PBL is that it situates students at the core of learning. Students are expected to explore problems, identify what they need to learn, and seek out relevant knowledge to propose solutions. This autonomy fosters a sense of ownership and responsibility, which increases intrinsic motivation. Motivated students are more likely to invest cognitive and emotional effort, ask questions, challenge assumptions, and reflect critically on their understanding behaviors that are fundamental to critical thinking development.

Moreover, student involvement enhances learning through active inquiry and collaborative dialogue. As students engage in group discussions, they are required to explain their reasoning, defend their viewpoints, and listen to differing perspectives. This interactive process promotes metacognition, as students evaluate their own thought processes and consider alternative arguments. Such experiences cultivate analytical, evaluative, and reflective thinking key components of critical thinking skills. PBL also encourages self-directed learning, where students identify learning objectives, seek information from multiple sources, and assess the reliability and relevance of data. This process not only deepens content knowledge but also trains students in research and judgment skills that are essential for critical thinking. The more students are involved in making decisions about their learning, the more opportunities they have to develop critical awareness and independent thought.

However, effective student involvement requires supportive learning environments. Teachers must create a culture of trust, where students feel safe to express ideas, make mistakes, and learn from feedback. Structured guidance, timely scaffolding, and clear expectations are also necessary to help students engage meaningfully with problems. In conclusion, student involvement is a vital factor in the success of Problem-Based Learning. It enhances motivation, fosters autonomy, and encourages the development of critical thinking skills through active, collaborative, and reflective learning processes. Educational practices that prioritize student engagement can thus significantly contribute to cultivating thoughtful, independent, and problem-solving learners.

The Role of Teachers in PBL

The teacher's role in PBL is significantly different from that in conventional instruction. Instead of being a knowledge transmitter, the teacher acts as a facilitator or guide. This shift in role was evident in the experimental class, where the teacher encouraged inquiry, posed probing questions, and guided students without providing direct answers. This method of facilitation supports students' autonomy and helps them take responsibility for their own learning. It also ensures that students remain on task, use critical questioning strategies, and reflect on their thought processes, thereby deepening their understanding.

In Problem-Based Learning (PBL), the role of the teacher shifts fundamentally from that of a traditional knowledge provider to a learning facilitator, mentor, and guide. This transformation is essential for creating a student-centered learning environment where critical thinking, problem-solving, and collaborative inquiry are prioritized. The success of PBL largely depends on the teacher's ability to manage this transition and effectively support student learning without dominating the process. One of the teacher's primary roles in PBL is facilitation. Instead of delivering content directly, teachers guide students as they explore complex, real-world problems. This includes posing open-ended questions, encouraging investigation, and prompting students to justify their reasoning. Through strategic questioning and scaffolding, teachers help students navigate cognitive challenges, refine their thought processes, and construct meaningful understanding. This facilitative role empowers students to take ownership of their learning, which is vital for the development of critical thinking.

Teachers also serve as observers and assessors in the PBL process. While students work in groups, teachers monitor discussions to assess engagement, collaboration, and the quality of reasoning. They provide feedback that is formative, encouraging students to reflect on their learning strategies and make improvements. Effective feedback promotes metacognition, a key element of critical thinking, by helping students become more aware of their cognitive strengths and areas for growth. In addition, teachers play a crucial role in designing meaningful problems and structuring learning activities that align with curriculum objectives. The problems presented must be authentic, relevant, and sufficiently complex to stimulate inquiry and critical analysis. Teachers must also plan appropriate resources and provide timely support, especially for students who struggle with self-directed learning.

Furthermore, the teacher sets the tone for a safe and supportive classroom climate, which encourages risk-taking, open dialogue, and respect for diverse perspectives. Creating such an environment is essential for effective group collaboration and critical discourse, which are at the heart of PBL. In conclusion, teachers are central to the success of Problem-Based Learning. Their role extends beyond delivering content to include facilitating inquiry, supporting reflection, assessing thinking processes, and fostering a positive learning atmosphere. By adopting these roles effectively, teachers can cultivate an environment that nurtures students' critical thinking skills and prepares them to face complex challenges in real-world contexts.

Contrast with Conventional Learning Methods

In contrast, the control group, which was taught through conventional teaching methods (lectures and rote learning), showed only modest improvement. Traditional instruction often emphasizes content delivery over cognitive engagement. Students passively receive knowledge with limited opportunities to analyze or apply information critically. This passive learning environment restricts students' ability to practice higher-order thinking skills. The findings align with constructivist learning theories, which argue that meaningful learning occurs when learners actively construct their own knowledge through experience and reflection, rather than merely absorbing information. PBL, rooted in constructivism, aligns with these principles and thereby supports the development of critical thinking.

Problem-Based Learning (PBL) differs significantly from conventional learning methods, particularly in its approach to developing students' critical thinking skills. Conventional or traditional instruction often emphasizes content transmission, where the teacher is the central figure who delivers information, and students are passive recipients. This method tends to rely heavily on lectures,

textbooks, and rote memorization, focusing more on factual recall than on analysis or synthesis of information.

In contrast, PBL is a student-centered learning approach that emphasizes active engagement, inquiry, and real-world problem-solving. Students are presented with complex, open-ended problems that require them to identify what they need to learn, research independently, collaborate with peers, and apply knowledge to find solutions. This process naturally promotes critical thinking, as students must evaluate information sources, justify their reasoning, and consider multiple perspectives before arriving at conclusions. One of the most fundamental contrasts lies in the role of the teacher. In conventional classrooms, teachers are typically knowledge authorities, responsible for delivering content in a structured manner.

In PBL, however, teachers act as facilitators, guiding students through the learning process with probing questions, scaffolding, and feedback, rather than simply providing answers.Another major difference is in the learning activities and assessment. Traditional methods often prioritize individual work, standardized testing, and correct answers. These practices may measure surface-level understanding but rarely challenge students to think critically or creatively. On the other hand, PBL involves collaborative group work, discussions, presentations, and reflective activities that assess not only what students know, but how they apply and reason through their knowledge. Moreover, student motivation and engagement tend to be higher in PBL environments.

Traditional methods can feel disconnected from students' lives and fail to show the relevance of learning. PBL connects academic content to real-life contexts, making learning more meaningful and encouraging deeper cognitive involvement. Lastly, conventional methods promote linear thinking and fixed curricula, whereas PBL fosters flexible, integrative thinking across disciplines. Students in PBL settings learn to approach problems holistically, a skill increasingly vital in today's complex world. In conclusion, while conventional methods may efficiently cover content, they often fall short in cultivating critical thinking. PBL offers a dynamic alternative that empowers students to think independently, solve problems collaboratively, and engage deeply with their learning.

Improving Critical Thinking Ability through PBL

The notable improvement in post-test scores among students taught with the PBL model indicates that this learning approach is effective in promoting critical thinking. This result is consistent with several previous studies which have emphasized that PBL encourages students to engage in active learning, analytical reasoning, and collaborative problem-solving. Critical thinking involves processes such as analysis, evaluation, inference, and self-regulation all of which are inherently embedded in the PBL framework. When students are presented with real-world problems and are required to analyze them, formulate hypotheses, explore alternative solutions, and justify their reasoning, they practice and develop these cognitive skills actively.

Furthermore, in the PBL environment, students are typically grouped into teams to tackle open-ended problems. These group interactions foster not only collaboration but also argumentation and reflective discussion two processes widely acknowledged as essential to the development of critical thinking. Problem-Based Learning (PBL) has emerged as an effective instructional model for fostering critical thinking skills among students. Unlike traditional learning approaches that focus on memorization and passive reception of information, PBL engages students in solving complex, real-world problems that demand analysis, reasoning, and decision-making. This active engagement is a key factor in improving students' critical thinking abilities.

In PBL, students are encouraged to identify problems, formulate questions, seek relevant information, and propose evidence-based solutions. This process inherently promotes the development of critical thinking components, such as analysis, interpretation, inference, explanation, evaluation, and self-regulation, as outlined in established frameworks like that of Facione or Ennis. By confronting ill-structured problems without a single correct answer, students must analyze multiple viewpoints, assess the credibility of sources, and justify their conclusions practices that directly exercise their critical faculties. Moreover, PBL emphasizes collaborative learning, where students work in small groups to solve problems. Through discussion and argumentation, students are exposed to diverse perspectives, which challenges them to refine their thinking and become more open-minded and reflective.

These peer interactions serve as a valuable platform for developing reasoning, questioning, and evaluative skills in a supportive yet intellectually stimulating environment. Another strength of PBL in enhancing critical thinking lies in its student-centered approach. PBL promotes autonomy by requiring learners to take responsibility for their own learning paths. This independence cultivates metacognitive

awareness, as students must constantly evaluate their understanding, monitor their progress, and adjust their strategies. Such reflective thinking is essential to becoming a critical thinker.

Furthermore, the real-world relevance of PBL tasks increases student motivation and engagement. When students see the practical value of their learning, they are more inclined to invest effort in exploring solutions critically and thoroughly. This deeper cognitive engagement leads to more meaningful learning experiences and sustained development of critical thinking skills. In conclusion, PBL is a powerful pedagogical approach for improving critical thinking ability. Through problem-solving, collaboration, self-directed inquiry, and reflective thinking, students develop the cognitive skills necessary to analyze complex issues, make informed decisions, and become independent learners. As such, integrating PBL into educational practices is a strategic step toward preparing students for the challenges of the 21st century.

Curriculum Implications and Assessment

The success of PBL in enhancing critical thinking has implications for curriculum design and assessment strategies. Curriculum developers should consider integrating PBL across subjects, especially in areas that require analytical and reflective thinking. Assessment strategies should also be aligned with the objectives of PBL. Instead of relying solely on multiple-choice tests, assessments should include open-ended questions, reflective journals, and performance tasks that require students to demonstrate reasoning, synthesis, and argumentation skills. The integration of Problem-Based Learning (PBL) into educational curricula carries significant implications for curriculum design and assessment strategies, especially with the aim of enhancing critical thinking skills among students. Traditional curricula often emphasize content coverage and standardized testing, which may not adequately foster higher-order cognitive abilities. In contrast, PBL requires curricula to be more flexible, student-centered, and focused on developing 21st-century skills such as critical thinking, problem-solving, collaboration, and self-directed learning.

From a curriculum design perspective, incorporating PBL involves structuring learning around complex, real-world problems rather than isolated topics or memorization of facts. This requires interdisciplinary approaches that connect knowledge across subjects, promoting integrative thinking. Curriculum planners need to ensure that learning objectives explicitly include critical thinking and problem-solving competencies. Additionally, curricula should provide sufficient time and resources for students to engage deeply with problems, collaborate with peers, and reflect on their learning processes.Another important implication is the shift in the teacher's role from content deliverer to learning facilitator, which influences how curricula are implemented. Professional development and training for teachers are essential so they can effectively design problems, scaffold student learning, and guide inquiry without dominating the process.

In terms of assessment, PBL challenges the effectiveness of traditional evaluation methods such as multiple-choice tests that primarily assess rote memorization. Instead, assessments must align with the goals of PBL by measuring students' ability to analyze, evaluate, synthesize information, and apply knowledge in novel contexts. This calls for more authentic, performance-based assessments including open-ended problem-solving tasks, portfolios, presentations, reflective journals, and peer evaluations. Formative assessment becomes critical in PBL environments, as ongoing feedback supports students' development of critical thinking and self-regulation. Teachers can assess not only the final product but also the process of inquiry, collaboration, and reasoning. Rubrics that clearly define criteria for critical thinking, teamwork, and problem-solving can help ensure fair and transparent assessment.

Furthermore, assessment outcomes should inform curriculum refinement and instructional strategies, creating a feedback loop that continually enhances educational quality. In conclusion, the adoption of PBL necessitates a paradigm shift in curriculum design and assessment. Curricula must be restructured to support active, integrative, and student-centered learning, while assessments need to authentically measure critical thinking and problem-solving skills. Aligning curriculum and assessment with PBL principles is essential to fully realize its benefits and prepare students for complex real-world challenges.

4. CONCLUSION

This study on the effect of the Problem-Based Learning (PBL) model on the critical thinking ability of junior high school students demonstrates that PBL is an effective instructional approach for enhancing students' higher-order cognitive skills. The research findings reveal that students who engaged in PBL exhibited significant improvements in their critical thinking abilities compared to those who experienced conventional teaching methods. This outcome confirms that PBL provides a more

conducive learning environment for cultivating essential skills such as analysis, evaluation, inference, and reflection. The success of PBL in improving critical thinking can be attributed to its student-centered and active learning nature. By presenting students with complex, real-world problems, PBL encourages learners to take responsibility for their own learning, engage in inquiry, and collaborate with peers. These processes demand that students think critically and creatively, develop problem-solving strategies, and communicate their reasoning effectively. The social interaction and reflective practices embedded in PBL further deepen students' metacognitive awareness, which is a crucial component of critical thinking. Moreover, this study highlights the important role of the teacher as a facilitator who guides students' inquiry without directly providing answers. The shift from a traditional instructor to a learning facilitator empowers students to develop autonomy and self-directed learning habits, which contribute to sustained critical thinking development. It also emphasizes the need for educators to design meaningful, challenging problems that stimulate curiosity and intellectual engagement. The findings also suggest that integrating PBL into junior high school curricula requires thoughtful consideration of curriculum design and assessment methods. Traditional content-focused curricula and standardized tests may not adequately capture the depth of students' critical thinking growth. Instead, curricula should incorporate interdisciplinary, problem-centered learning activities, and assessments should include authentic tasks that evaluate both the process and products of critical thinking. Despite its promising results, this study acknowledges limitations such as the relatively short duration of the intervention and the quasi-experimental design. Future research could explore long-term effects, implementation fidelity, and the impact of teacher training on PBL effectiveness. In conclusion, the Problem-Based Learning model offers a powerful pedagogical approach for improving junior high school students' critical thinking skills. By fostering active engagement, collaboration, and reflective inquiry, PBL equips students with the cognitive tools necessary to navigate complex problems both inside and outside the classroom. Educational stakeholders are encouraged to adopt and support PBL to prepare students for the demands of the 21st century.

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