

Implementation of Problem-Based Learning Based on Local Wisdom to Improve Students' Critical Thinking Skills

Beni Setiawan^{1*} Fiainil Mufidah², Ruqoyyah Amilia Andania³ Raka Prasetyo Nurhaddi⁴

^{1,2,4}Faculty of Mathematics and Natural Science, Universitas Negeri Surabaya, Indonesia

³Department of Education and Human Potentials Development, National Dong Hwa University, Taiwan

ABSTRACT

Critical thinking is one of the essential skills students need to navigate the challenges of the 21st century. Critical thinking can be developed through effective learning models and local wisdom approaches that support learning. This research aims to describe the improvement of critical thinking skills and students' responses to a Problem-Based Learning model based on local wisdom. The research used a quasi-experimental design. The subjects targeted are seventh-grade students at a state junior high school in Kediri Regency. The data collection techniques used are Pre-test and Post-test with essay questions containing critical thinking indicators, and the students' responses after the learning process. The research results showed a significant improvement in critical thinking skills in the classroom, using the Problem-Based Learning model based on local wisdom. The students' responses to this model were categorized as good. This study concludes that the implementation of the Problem-Based Learning model, grounded in local wisdom, is effective in enhancing students' critical thinking skills. The contributions of this research were expected to develop an innovative learning model incorporating local wisdom in science education, aiming to achieve the goal of developing critical thinking skills.

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*Correspondent Author:

Beni Setiawan

Email:

benisetiawan@unesa.ac.id

INTRODUCTION

The 21st-century education is faced with complex challenges that demand a generation with high-level adaptive and critical thinking skills. Among these essential skills, critical thinking skills occupy a central position. Critical thinking is not merely the ability to recall or comprehend information; rather, it is the capacity to analyze, evaluate, synthesize, draw logical conclusions, and make evidence-based decisions independently (Facione, 2023). These competencies establish the basis for active engagement in a democratic society, the resolution of complex problems in the workplace, and the development of innovations in various domains (World Economic Forum, 2020). However, numerous national and international studies, including PISA (Program for International Student Assessment) and TIMSS (Trends in International Mathematics and Science Study), have consistently shown that the critical thinking skills of Indonesian students remain comparatively underdeveloped. Students frequently encounter challenges when tasked with analyzing information, evaluating arguments, connecting concepts, or applying knowledge in novel contexts (OECD, 2019; Kemendikbudristek, 2022).

The current curriculum must prioritize the development of soft skills, including communication, teamwork, problem-solving, and adaptability (Tunas & Pangkey, 2024). The "Merdeka Curriculum" has become an option in the field of education. Through this curriculum, educators are given the freedom to implement learning that is more closely aligned with the needs of students and focused on

character strengthening (Kemendikbud, 2024). The 21st century requires students to be active in developing their ideas, which is closely linked to the creativity of educators in designing learning models that meet students' needs (Salhuteru et al., 2023). The skills that 21st-century students need to possess include: 1) Learning Skills (critical thinking, creativity, collaboration, communication); 2) Literacy Skills (information, media, technology); and 3) Life Skills (flexibility, leadership, initiative, productivity, social skills) (Team iCEV, 2024). One of the competencies required to address the challenges of the 21st century is critical thinking (Sumarni, 2019).

Based on data from observations and interviews with a science teacher at a junior high school in Kediri Regency, it was found that the average student still has low critical thinking skills. This is due to the learning model applied being teacher-centered, where students only complete school assignments. Based on pre-research results, it was found that the average critical thinking skills of students were 35.01%, which is categorized as very low according to the criteria by Karim (2015). To surmount these challenges, a paradigm shift is necessary towards student-centered learning, an approach that emphasizes activity, inquiry, and the active involvement of students in the process of constructing their knowledge. One learning model that is both theoretically and empirically validated for developing critical thinking skills is Problem-Based Learning (PBL).

Problem-Based Learning (PBL) is an educational approach in which students collaborate to solve authentic, complex, and ill-structured problems as a starting point for learning the concepts and principles of scientific disciplines (Barrows, 1996; Savery, 2006). The core process of PBL involves the following stages: 1) Facing a problem; 2) identifying what is known and what needs to be learned (knowledge gap); 3) developing hypotheses and solution strategies; 4) seeking and evaluating information; 5) applying new knowledge to solve the problem, and; 6) reflecting on the process and solution (Hmelo-Silver, 2004). In this cycle, students are actively engaged in the processes of inquiry, analysis, synthesis, and evaluation, which are at the core of critical thinking. A meta-analysis of research conducted by Strobel & van Barneveld (2009) and Dochy et al. (2003) indicates that Problem-Based Learning (PBL) is significantly more effective than traditional learning methods in enhancing critical thinking skills and long-term problem-solving abilities. This is supported by Masrinah et al. (2023), who found that PBL has a positive impact on critical thinking abilities. This is confirmed by the increase in Gain scores across five indicators of critical thinking skills.

The PBL model can develop students' curiosity in exploring their existing knowledge. Moreover, students will independently learn from the problems presented, so through the activities of finding and solving these problems, they can develop their critical thinking skills (Muharni et al., 2019). The low quality of critical thinking among students can also be attributed to science education that pays little attention to the socio-cultural environment (Temuningsih et al., 2017). However, the implementation of PBL is less effective than conventional learning methods. This is primarily due to the significant time investment required, as well as the inadequate resolution of material issues.

Furthermore, the problems solved are not exclusively based on specific concepts, which can make them challenging for teachers to identify, as they must adapt to students' varying levels of cognitive development (A'yun et al., 2025). The concept of Local Wisdom has the potential to offer significant solutions that have not yet been fully explored. Local wisdom can be defined as the knowledge, values, norms, beliefs, traditions, and practices that have been developed within a particular cultural community over generations. Learning activities that incorporate local wisdom values in discussing problems in the surrounding environment facilitate students' understanding of the learning material (Puspita et al., 2024). Problem-solving based on local wisdom encourages students to be independent, active, and more creative in solving problems, while also training them in collaboration and responsibility (Budiarti & Airlanda, 2019). Through a learning model based on local wisdom, social attitudes and critical thinking are enhanced by the introduction of the surrounding

environment and an understanding of the material (Soraya et al., 2018). The difference between this study and previous studies lies in the type of local wisdom that is used as the context for learning. This study employs a PBL model based on the local wisdom of Tahu Takwa, a typical food of Kediri city, which is linked to learning about water pollution. This study aims to determine the effectiveness of the local wisdom-based PBL learning model in improving students' critical thinking skills and to describe students' responses to the local wisdom-based PBL learning.

METHOD

The design used in this study is a Quasi-Experimental Design with a Non-Equivalent Control Group. The sampling technique used is purposive sampling, meaning the experimental and control classes were not selected randomly (Creswell, 2014). This study involves two sample groups: the experimental and control classes. The experimental class was treated with a Problem-Based Learning model based on local wisdom, and the control class was treated with the usual teacher-centered learning model in the school.

The research was conducted at SMA Negeri 1 of Ngasem in May 2024. The subjects of this study are seventh-grade students, with two classes selected: VII-F as the control class and VII-G as the experimental class. Each class consists of 34 students. The data analysis technique used SPSS to perform normality tests, homogeneity tests, and independent sample t-tests. Improvement in critical thinking skills can be assessed through the score. The Gain Score is presented in Table 1. The categories of critical thinking skills can be determined through Table 2.

Table 1. Gain Score Categories

Gain Score	Categories
$g \geq 0,7$	High
$0,3 \leq g < 0,7$	Medium
$g < 0,3$	Low

Table 2. Categories of Critical Thinking

Score	Categories
$81,25 < X \leq 100$	Very High
$71,50 < X \leq 81,25$	High
$62,5 < X \leq 71,50$	Medium
$43,75 < X \leq 62,50$	Low
$0 < X \leq 43,75$	Very Low

Students' responses to the implementation of local wisdom-based PBL learning were obtained using a questionnaire. The student response questionnaire employs a Likert scale with four rating criteria: SA (Strongly Agree), A (Agree), DA (Disagree), and SDA (Strongly Disagree), with 14 positive statements. The students' responses, categorized by the PBL-based local wisdom learning, can be seen in Table 3.

Table 3. Criteria for Students' Responses

Percentage (%)	Description
0 - 20	Very Bad
21 - 40	Bad
41 - 60	Sufficient
61 - 80	Good
81 - 100	Very Good

RESULTS AND DISCUSSION

Data on the improvement of critical thinking skills were obtained from the pre-test and post-test scores, each of which contained critical thinking indicators. The critical thinking indicators used by Ennis (1995) include five key aspects: focusing on the questions; observing and considering the results of observation; making and considering inductive arguments; defining terms and considering the results of definitions; and deciding on an action. The average gain score results for the five indicators in the experimental and control classes are shown in Figure 1.

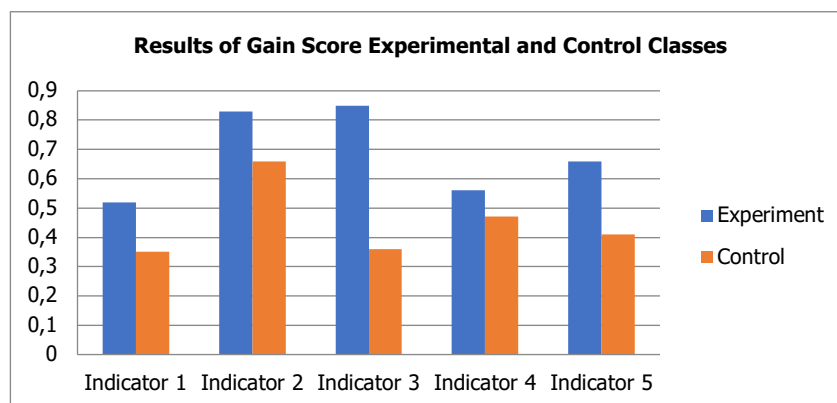


Figure 1. Average Gain Score Critical Thinking Skills for Each Indicator in the Experimental and Control Classes

The critical thinking indicator of focusing questions in the experimental class has a Gain score of 0.52, categorized as medium, while in the control class, it had a Gain score of 0.35, also categorized as medium. This indicates that the increase in Gain score is greater in the experimental class using the local wisdom-based PBL model compared to the control class, which focuses on the teacher explaining the material. Through the problem orientation phase in the PBL model, students are guided to formulate problems from the given issues, thereby gradually learning to think critically by habitually formulating problems and providing explanations when answering questions (Leicester & Taylor, 2010). Students who are only asked to memorize are not required to provide explanations before getting to the core answer (Qurniati et al., 2015).

The critical thinking indicator, which involves observing and considering observation results in the experimental class, had a Gain score of 0.83, categorized as high. In contrast, the control class had a Gain score of 0.66, categorized as medium. The most significant increase was observed in the experimental class, as students were trained to think critically through experiments and observations in the PBL phase. This training enabled them to explain the results of the experiments and connect them to the material being studied (Qurniati et al., 2015). The highest critical thinking score in the control class was on this indicator. This is because the test items provided by the researcher included data in the form of tables, not just abstract sentences, making it easier for students to answer the questions (Harmaida & Winarni, 2023). This is also due to the initial abilities possessed by the control class students, as initial abilities can influence the success of learning (Qurniati et al., 2015).

The critical thinking indicator of making inductions and considering induction results in the experimental class has a Gain score of 0.85, categorized as high, while in the control class, it has a Gain score of 0.36, categorized as medium. This proves that the critical thinking skills of the experimental class increased significantly more than those of the control class. This is because the students' ability to conclude in the experimental class was trained in solving problems using inductive thinking patterns by concluding the activities of collecting information, data, and specific concepts conducted

to solve the problem (Husen et al., 2017). The ability to conclude in the teacher-focused class is still lacking, as evidenced by the difference in Gain scores compared to the experimental class. Teacher-centered learning does not involve students in concluding, whereas the ability to conclude can be developed through activities that apply principles and concepts, as well as the skills learned, to solve problems (Mariya, 2023). The critical thinking indicator of defining terms and considering definition results in the experimental class has a Gain score of 0.56, categorized as medium, while in the control class, it has a Gain score of 0.47, also categorized as medium. This proves that the increase in the Gain score is greater in the experimental class using the local wisdom-based PBL model. Through the PBL model, students can develop and refine their thinking skills based on the knowledge they possess, enabling them to provide clear and detailed descriptions (Ontowijoyo et al., 2022).

The critical thinking indicator of determining actions in the experimental class has a Gain score of 0.66, categorized as medium, while in the control class, it has a Gain score of 0.41, also categorized as medium. This indicates that the increase in the Gain score in the class using the local wisdom-based PBL model is higher than in the class that focuses solely on the teacher's explanation. Through activities in the PBL model, students are trained and use their critical thinking skills in determining actions to solve the presented problems. Through discussion activities in the PBL model, students interact and share knowledge, finding solutions to the problems they face (Temuningsih et al., 2017). The independent sample t-test was used to determine the average difference between class VII-G, the experimental class, and class VII-F, the control class.

Table 4. Results of the Independent Sample t-Test

	Df	Sig. (2-tailed)
Post-test	66	< 0,001
	61,4	< 0,001

Based on Table 4, the significance value (Sig.) is shown as < 0.001. This indicates that the significance value is < 0.05, leading to the rejection of H_0 and acceptance of H_1 . This indicates a difference in critical thinking skills between the experimental class and the control class. H_0 there is no difference in critical thinking skills between the experimental class and the control class. H_1 There is a difference in critical thinking skills between the experimental class and the control class. The results of the independent sample t-test using SPSS are presented in Table 5.

Table 5. Average Gain Score for Experimental and Control Classes

Class	Average Gain Score	Categories	Percentage (%)	Critical Thinking Categories
Eksperimental	0,68	Medium	68	Medium
Control	0,45	Medium	45	Low

Based on Table 5, the experimental class with the local wisdom-based PBL model had an average Gain score of 68%, categorized as medium in critical thinking categories, while the control class had an average Gain score of 45%, categorized as low in critical thinking categories. This indicates that the experimental class had a higher average score compared to the control class. The class that implemented the local wisdom-based PBL model demonstrated a significant improvement in critical thinking skills compared to the class that focused solely on teacher-centered instruction. Student responses to the local wisdom-based Problem-Based Learning model are presented in the table below.

Table 6. Students' Responses Data

Indicator	Number	Average Indicators (%)	Categories
Interest in the application of local wisdom-based PBL models	1,4	76	Good
Fostering learning motivation	13	74	Good
Clarity in the assignment	7	84	Very Good
Makes it easy to understand the concept	2, 3, 5, 6	80	Good
Problem solving	9, 10, 11, 12, 14	80	Good
Working together in a group	8	80	Good
Average		79	Good

Based on Table 6, the average result of students' responses across six indicators is 79, categorized as "good". The local wisdom-based PBL model can foster critical thinking skills through active student involvement in learning, motivating students to engage in learning, and providing a meaningful learning atmosphere through observation, questioning, discussion, and communication activities (Temuningsih et al., 2017). Nowadays, learners dislike learning that is material or written (Larsson, 2017). Through meaningful learning experiences, students have the opportunity to express their opinions orally or in writing on phenomena that challenge their critical thinking skills (Curto & Byer, 2005). Meanwhile, learning through the lecture method makes students rely solely on concepts from books and explanations from teachers, resulting in a lack of thinking skills (Temuningsih et al., 2017).

This research constitutes a context-specific integration of the Problem-Based Learning (PBL) model with the concrete local wisdom inherent in the process of producing "Tahu Takwa" in Kediri City, to study the topic of water pollution. This approach is a response to the critiques leveled at PBL implementation, which is frequently denounced as being time-consuming and employing problems that are excessively abstract or disassociated from students' lives. The integration of the "Tahu Takwa" paradigm in Kediri represents a novel approach, as it offers an authentic, Culturally Relevant, and Concrete Problem for students. The efficacy of this method in enhancing Science Critical Thinking Skills among junior high school students remains uncharted territory in extant literature.

This research makes significant contributions to the field in multiple ways. Empirical evidence from this research demonstrates the efficacy of a local wisdom-based PBL model in enhancing students' critical thinking skills when compared to conventional teacher-based learning methodologies. This research provides a practical framework and substantiated evidence of success that educators can implement to achieve their goals. The model provides concrete examples for teachers to integrate local contexts, such as local industries or traditions, into science learning, thereby rendering the material more relevant and easier to understand, while also motivating students. From a policy perspective, this research aligns with the fundamental principles of the Merdeka Curriculum, which emphasizes the importance of teacher autonomy, character development, and the relevance of learning to local needs and contexts, providing an empirical foundation for promoting the integration of local wisdom in curriculum development and teacher training. Theoretically, this research enhances the comprehension of PBL by demonstrating that integrating problems within a particular local wisdom framework can address the limitations of PBL and considerably augment its efficacy in cultivating higher-order thinking skills, thereby aligning with socio-cultural learning theory.

CONCLUSION

Based on the conducted research, it can be concluded that the improvement in critical thinking skills through the implementation of the Problem-Based Learning model, grounded in local wisdom, in the sub-topic of Water Pollution for seventh-grade students at SMA Negeri 1 of Ngasem is quite effective. This is evidenced by the average Gain score summary results from the five indicators, where class VII-G, as the experimental class, shows higher scores when compared to class VII-F, the control class. The average percentage of critical thinking skills in the experimental class was categorized as medium, whereas the control class was categorized as low. Student responses to the Problem-Based Learning model based on local wisdom are generally in the good category.

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