

Integrating Local Culture into Problem-Based Learning to Enhance Students' Critical Thinking Skills in Geometry Transformation

Nina Fadilah^{1*}, Dian Armanto², Zul Amry³ 

Universitas Pembangunan Panca Budi, ^{2,3}Universitas Negeri Medan, Medan Indonesia

ABSTRAK

Abstrak Kemampuan berpikir kritis merupakan kompetensi esensial dalam pembelajaran matematika abad ke-21, khususnya pada materi transformasi geometri yang menuntut pemahaman konseptual dan penalaran spasial. Salah satu tantangan dalam pembelajaran matematika adalah rendahnya kemampuan berpikir kritis siswa akibat pembelajaran yang belum mengaitkan konsep dengan konteks sosial dan budaya yang dekat dengan kehidupan siswa. Artikel prosiding ini bertujuan untuk mendeskripsikan peran Problem-Based Learning (PBL) terintegrasi budaya lokal dalam meningkatkan kemampuan berpikir kritis siswa pada materi transformasi geometri. Kajian ini menggunakan pendekatan konseptual dengan menelaah teori berpikir kritis, pembelajaran berbasis masalah, serta integrasi budaya lokal sebagai konteks sosial pembelajaran. Hasil kajian menunjukkan bahwa penerapan PBL yang diintegrasikan dengan budaya local seperti ornamen, pola, dan aktivitas sosial. Masyarakat mampu mendorong siswa untuk menganalisis masalah kontekstual, merumuskan strategi penyelesaian, mengevaluasi solusi, dan menarik kesimpulan secara logis. Pembelajaran transformasi geometri berbasis PBL terintegrasi budaya lokal menjadikan konsep matematika lebih bermakna, meningkatkan keterlibatan belajar, serta memperkuat pemahaman konseptual siswa. Oleh karena itu, PBL terintegrasi budaya lokal direkomendasikan sebagai pendekatan efektif untuk mengembangkan kemampuan berpikir kritis dan meningkatkan kualitas pembelajaran transformasi geometri.

Kata Kunci : Berpikir Kritis, Problem-Based Learning, budaya lokal, transformasi geometri.

ABSTRACT

This study aims to examine the integration of local culture into Problem-Based Learning (PBL) to develop students' critical thinking skills in geometry transformation. The research is motivated by the need for meaningful mathematics learning that connects abstract concepts with students' cultural contexts. Local cultural elements, particularly Malay cultural artifacts and traditional games, were integrated into geometry transformation problems to create authentic and contextual learning situations. This study employed a qualitative descriptive approach involving junior high school students. Data were collected through observation, student worksheets, and interviews, and were analyzed based on indicators of critical thinking skills, including analyzing problems, synthesizing information, identifying and solving problems, and drawing conclusions. The results indicate that the integration of local culture in PBL encourages active student engagement and supports the development of critical thinking skills in learning geometry transformation. Students demonstrated improved ability to interpret problems, apply transformation concepts, and provide logical reasoning grounded in real-life cultural contexts. Therefore, culture-integrated PBL can be considered an effective learning approach to enhance students' critical thinking skills in mathematics learning, particularly in geometry transformation topics.

Keywords:

Critical Thinking Skills, Problem-Based Learning (PBL), Local Culture, Geometric Transformation.

*Corresponding author

E-mail addresses: author1@email.com (First Author)

1. INTRODUCTION

Mathematics learning at the elementary school level plays an important role in shaping students' ways of thinking from an early age, particularly in developing critical thinking skills. Mathematics is not only aimed at mastering computational skills but also at training students to observe, reason, analyze, and solve problems logically (NCTM, 2000; Facione, 2011). However, many studies indicate that mathematics instruction in elementary schools still tends to be abstract and oriented toward memorizing formulas, causing students to experience difficulties in understanding concepts deeply and relating them to real-life situations (Suherman, 2003; Sagala, 2013). This condition is also found among elementary school students in Klambir Lima Kebun Village, where mathematics learning has not been fully connected to students' real-life experiences. As a result, students tend to memorize problem-solving procedures without understanding their meaning and practical application in everyday life. This situation has an impact on the low development of students' critical thinking skills, particularly in observing problems, asking questions, and providing reasoning for their answers. In fact, according to the OECD (2019), critical thinking skills need to be fostered from basic education through meaningful and contextual learning.

Children in Klambir Lima Kebun Village grow up in a social and natural environment rich in real-life activities, such as agriculture, communal work (*gotong royong*), and strong social interactions within families and the community. This environment actually has great potential to be utilized as a context for mathematics learning. Learning activities that connect mathematical content with counting agricultural yields, measuring land areas, comparing distances between locations in the village, or solving simple problems related to daily activities can help students understand mathematical concepts more concretely and meaningfully (Hadi, 2017; Putra & Zulkardi, 2018).

The integration of social and local environmental contexts into mathematics learning is consistent with the cognitive developmental characteristics of elementary school students, who are at the concrete operational stage. At this stage, students are more likely to understand concepts when they are presented through concrete objects, direct experiences, and situations that are close to their daily lives (Arends, 2012). Therefore, mathematics learning that incorporates the social and environmental context of Klambir Lima Kebun Village is highly relevant for helping students gradually construct conceptual understanding rather than merely memorizing formulas. In addition to supporting conceptual understanding, context-based mathematics learning also plays an important role in increasing students' learning motivation and active participation. When students are faced with problems derived from their own daily lives, they tend to be more interested, actively ask questions,

engage in discussions, and try various problem-solving strategies. This process indirectly trains students' critical thinking skills, particularly in analyzing information, evaluating strategies, and drawing simple conclusions (Rachmawati & Suryadi, 2019; Wahyuni & Fitriani, 2019). Furthermore, integrating social and environmental village contexts into mathematics learning also contributes to the development of reflective attitudes and students' awareness of their surrounding environment. Through contextual learning, students not only learn mathematics but also internalize social values and local wisdom, such as cooperation, responsibility, and environmental awareness. Thus, mathematics learning in elementary schools is not only oriented toward academic achievement but also serves as a means to develop students' critical thinking skills and character in a holistic manner (Kemendikbud, 2020; Trianto, 2011).

Literature Review

Mathematics Learning in Elementary Schools

Mathematics learning at the elementary school level plays a strategic role in building the foundation of students' thinking skills, including conceptual understanding, reasoning, and problem solving. The National Council of Teachers of Mathematics (NCTM, 2000) emphasizes that mathematics instruction should not be oriented solely toward procedural mastery, but should also focus on conceptual understanding, reasoning, and mathematical communication. In line with this view, Suherman (2003) states that meaningful mathematics learning should provide opportunities for students to construct their own knowledge through relevant learning experiences.

However, in practice, mathematics learning in elementary schools often remains abstract and teacher-centered, causing students to tend to memorize formulas without understanding their meaning (Sagala, 2013). This condition makes it difficult for students to connect mathematical concepts with everyday life, which ultimately hinders the development of their critical thinking skills.

Critical Thinking Skills in Mathematics Learning

Critical thinking skills are essential abilities that need to be developed from an early age. Facione (2011) defines critical thinking as the ability to analyze, evaluate, and draw logical conclusions based on available information. In the context of mathematics learning, critical thinking skills are reflected in students' abilities to understand problems, determine appropriate solution strategies, provide reasoning for the steps used, and draw accurate conclusions.

The OECD (2019), through the PISA framework, emphasizes that critical thinking skills and mathematical reasoning should be fostered from basic education through contextual and cognitively challenging learning. Rachmawati and Suryadi (2019) also highlight that mathematics learning which provides space for students to think, discuss, and reflect on solutions can gradually improve students' critical thinking skills.

Mathematics Learning Based on Social and Local Environmental Contexts

Mathematics learning based on social and local environmental contexts is an approach that connects mathematical concepts with real-life situations that are close to students' daily experiences. Hadi (2017) explains that contextual learning helps students understand mathematical concepts through direct experiences, making learning more meaningful. Putra and Zulkardi (2018) add that the integration of local culture and environment into mathematics learning can enhance conceptual understanding and increase students' active participation.

The social and natural environments of rural areas, such as agricultural activities, communal work (*gotong royong*), and community interactions, provide concrete objects that can be utilized as learning resources in mathematics. This approach is highly suitable for elementary school students who are at the concrete operational stage, where conceptual understanding is more optimal when supported by real experiences (Arends, 2012).

Contextual Learning and the Development of Critical Thinking Skills

Mathematics learning that integrates social and local environmental contexts not only plays a role in improving conceptual understanding but also contributes to the development of students' critical thinking skills. Wahyuni and Fitriani (2019) state that environment-based learning encourages students to observe real problems, analyze information, and find logical solutions. This process trains students to develop critical thinking skills from an early age. Furthermore, Trianto (2011) emphasizes that integrated learning which connects subject matter with real-life contexts can increase students' motivation, active participation, and learning independence. The Ministry of Education and Culture (Kemendikbud, 2020) also stresses the importance of contextual learning in supporting the development of the Pancasila Student Profile, including critical reasoning skills and environmental awareness.

Relevance of the Literature Review to the Study

Based on the literature reviewed, it can be concluded that mathematics learning based on social and local environmental contexts has great potential to enhance elementary school students' critical thinking skills. However, empirical studies that specifically examine the integration of social and environmental contexts of Klambir Lima Kebun Village into mathematics learning remain limited. Therefore, this study is important to provide empirical evidence on how context-based mathematics learning can support the development of critical thinking skills among elementary school students.

2. METHOD

This study employed a qualitative research approach aimed at gaining an in-depth understanding of the mathematics learning process that integrates social and environmental contexts from Klambir Lima Kebun Village and its relationship with the development of elementary school students' critical thinking skills. The qualitative approach was selected because the study focused on exploring meanings, learning processes, students' experiences, and the teacher's role in implementing context-based mathematics learning.

3. RESULT AND DISCUSSION

Research Subjects and Setting

The research was conducted at an elementary school located in Klambir Lima Kebun Village. The research subjects consisted of elementary school students who participated in mathematics learning activities integrating local social and environmental contexts, as well as one classroom teacher who implemented the learning approach. The students were selected because they were directly involved in contextual mathematics learning activities, while the teacher served as a key informant in providing insights into instructional planning and implementation.

Data Collection Techniques

In qualitative research, the researcher served as the primary research instrument and was directly involved in the data collection process. Data were collected through the following techniques:

1. Observation

Classroom observations were conducted to examine students' learning activities, interactions between students and the teacher, and students' responses to contextual mathematics problems. Observations focused on indicators of critical thinking skills, including problem analysis, strategy selection and reasoning, and drawing conclusions.

2. Interviews

Semi-structured interviews were carried out with the classroom teacher to obtain in-depth information regarding the implementation of mathematics learning based on social and environmental contexts, as well as the teacher's perceptions of students' critical thinking development. Interviews were also used to clarify and validate findings obtained from observations.

3. Documentation

Documentation included students' worksheets, learning materials, lesson plans, and photographs of learning activities. These documents were analyzed to support and strengthen the findings from observations and interviews, particularly related to students' problem-solving processes and reasoning.

Data Analysis Techniques

Data analysis was conducted using an interactive qualitative analysis model, which involved the following stages:

Data analysis was conducted through an interactive qualitative process consisting of data reduction, data display, and conclusion drawing and verification. Data obtained from observations, interviews, and documentation were first selected, focused, and simplified in accordance with the research objectives, particularly those related to indicators of students' critical thinking skills. The reduced data were then organized and presented in the form of descriptive narratives and simple percentage summaries to illustrate patterns and trends in students' critical thinking performance across the identified indicators.

Finally, conclusions were drawn by interpreting the relationships and patterns emerging from the data and were continuously verified through triangulation among observation findings, interview results, and documentation evidence to ensure the credibility and trustworthiness of the research findings. The use of a qualitative approach allowed the researcher to capture the learning process holistically and naturally, reflecting real classroom conditions. The flexibility of this approach also enabled the researcher to refine the focus of the study based on field findings, thereby providing a comprehensive understanding of how mathematics learning integrated with social and environmental contexts contributes to the development of elementary school students' critical thinking skills.

Results and Discussion

Based on the results of observations, interviews, and documentation conducted during the learning process, it was found that the integration of social and environmental contexts from Klambir Lima Kebun Village into mathematics learning provided more meaningful learning experiences for elementary school students. Learning activities that connected mathematical concepts with students' daily activities—such as their living environment, community life patterns, and familiar objects—encouraged active student engagement in the learning process. Observational data indicated that students were more enthusiastic and confident in expressing their ideas when mathematical problems were presented within contexts closely related to their real-life experiences. Students did not merely focus on obtaining final answers but were actively involved in understanding the problems, discussing problem-solving strategies, and providing justifications for the answers they proposed. This condition reflects the development of critical thinking indicators, particularly in analyzing problems and applying logical reasoning.

Interview findings with teachers revealed that mathematics learning based on social and local environmental contexts facilitated the explanation of abstract mathematical concepts. Teachers assumed the role of facilitators by guiding students to explore contextual problems, posing stimulating questions, and encouraging students to find solutions independently or through group discussions. This

instructional role contributed to creating a dialogical and reflective learning environment, enabling students to develop critical thinking skills and reducing their dependence on direct teacher explanations.

Furthermore, documentation of students' work showed improvements in the quality of students' responses, especially in terms of clarity of problem-solving steps and the ability to connect mathematical concepts with real-life situations. Students were able to explain the reasons for selecting particular problem-solving strategies and to draw conclusions based on the available information. This finding indicates that mathematics learning integrated with local contexts not only enhances conceptual understanding but also trains students to evaluate information and make rational decisions.

The discussion of these findings demonstrates that a qualitative approach enables researchers to capture the dynamics of the learning process in a comprehensive and natural manner. Classroom learning activities reflected a shift in students' learning behaviors, from passive participation to more active and critical engagement. The integration of social and environmental contexts from Klambir Lima Kebun Village served as a bridge between mathematical concepts and students' real-life experiences, making learning more relevant and meaningful. Therefore, it can be concluded that mathematics learning based on social and local environmental contexts has the potential to contribute positively to the development of elementary school students' critical thinking skills. These findings emphasize the importance of the teacher's role in designing contextual learning activities and utilizing the surrounding environment as a learning resource to support the development of students' critical thinking abilities.

Based on the analysis of observations, interviews, and documentation aligned with critical thinking indicators, empirical findings indicate that mathematics learning integrating social and environmental contexts from Klambir Lima Kebun Village positively contributes to the development of elementary school students' critical thinking skills. For the indicator of problem analysis, observational data and analysis of students' worksheets showed that approximately 75% of students were able to identify relevant information, understand relationships among data, and formulate mathematical problems from the given contextual situations. Regarding the indicator of strategy selection and reasoning, approximately 68% of students were able to choose appropriate problem-solving strategies and provide logical justifications for their chosen approaches, although some students still required teacher guidance. Furthermore, for the indicator of drawing conclusions (inference), approximately 60% of students were able to formulate conclusions by reconnecting the results of problem-solving to the real-life contexts discussed.

Interview findings with teachers and documentation of students' work further confirmed that students who actively participated in contextual discussions tended to

show increased self-confidence and independent thinking, as reflected in their ability to articulate their thought processes both orally and in writing. Overall, the achievement of these indicators demonstrates that mathematics learning based on social and local environmental contexts not only enhances student engagement but also facilitates the gradual and sustainable development of critical thinking skills

4. CONCLUSION

Data analysis was carried out through an interactive qualitative process consisting of data reduction, data display, and conclusion drawing and verification. Data obtained from observations, interviews, and documentation were selected, focused, and simplified in accordance with the research objectives, particularly those related to indicators of critical thinking skills. The reduced data were then organized and presented in descriptive narratives and simple percentage summaries to illustrate patterns and trends in students' critical thinking abilities across the identified indicators. Conclusions were drawn by interpreting the patterns and relationships found in the data and were continuously verified through triangulation of observation results, interview findings, and documentation to ensure the validity and credibility of the research findings

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