# ANALYSIS OF GRADE V STUDENTS' DIFFICULTIES IN SOLVING MATHEMATICS PROBLEMS BASED ON LOCAL CULTURE

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***Abstract***

Mathematics learning that is disconnected from the cultural context of students often makes it difficult to understand concepts, especially at the elementary school level. Integration of local culture through an ethnomathematics approach is believed to be able to bridge this gap, but has not been widely studied from the perspective of students' cognitive and contextual difficulties. This study aims to identify and analyze the forms of difficulties faced by fifth grade students in solving mathematics problems based on the local Batak Angkola culture. This study uses a qualitative descriptive approach with 37 fifth grade students at SD Negeri 200117 Padangsidimpuan as subjects. Data collection techniques include observation, semi-structured interviews, and analysis of student work artifacts. Validation is carried out through triangulation of sources and time. Five main types of difficulties were found: understanding cultural context (27.03%), mathematical conceptual errors (21.62%), procedural errors (18.92%), calculation errors (16.22%), and not solving problems (16.22%). The conclusion of this study is that dominant difficulties arise due to the low connection between cultural representations in problems and students' mathematical understanding. A contextual learning strategy is needed that is designed with strengthening cultural literacy so that the integration of ethnomathematics becomes more effective.

***Keywords:*** *Ethnomathematics; Learning Difficulties; Batak Angkola; Contextual; Elementary School Students.*

***Abstract***

Mathematics instruction disconnected from students' cultural context often hinders concept comprehension, especially at the elementary level. Integrating local culture through an ethnomathematical approach is believed to bridge this gap, yet little research has explored students' difficulties from cognitive and contextual perspectives. This study aims to identify and analyze fifth-grade students' difficulties in solving mathematics problems based on the Batak Angkola cultural context. A qualitative descriptive method was employed with 37 students from Class VB at SD Negeri 200117 Padangsidimpuan as participants. Data were collected through classroom observations, semi-structured interviews, and student-written work analysis. Validation was conducted using source and time triangulation. Five main categories of difficulty emerged:

understanding cultural context (27.03%), conceptual errors (21.62%), procedural errors (18.92%), calculation errors (16.22%), and failure to complete the task (16.22%). The dominant challenge was the disconnection between cultural representations of the problem and students' mathematical understanding. Contextual learning strategies strengthened by cultural literacy are necessary to enhance the effectiveness of ethnomathematical integration.

***Keywords:*** *Ethnomathematics; Learning Difficulties; Angkola Batak; Contextual Learning; Primary School Students*.

## INTRODUCTION

The skills of constructing arguments coherently, evaluating deeply, and assessing sharply will grow along with a thorough understanding of mathematical material. However, the reality in the field shows that many elementary school students still consider mathematics as a difficult, boring, and burdensome subject.(Wulandari et al., 2023). When faced with problems, especially in the form of numbers, they often feel afraid of failing because they think they do not have adequate knowledge and experience. This condition is exacerbated by teachers who do not master the methods, interests, and development of students according to their environment.(Sabrina et al., 2025). Therefore, a warmer, interactive, and environmentally relevant mathematics learning method needs to be implemented so that students can get closer to and understand mathematics from the start.

The level of mathematical literacy of Indonesian students is still below the average of OECD countries according to PISA results, which indicates structural problems in national mathematics learning.(Chasanah et al., 2024). This is exacerbated by monotonous, teacher-centered, and non-contextual teaching methods, so that the material is delivered abstractly without any connection to the students' real lives.(Sahliah, 2023). As a result, many students only memorize formulas without really understanding the concepts behind them, feel that the lessons are less meaningful, and eventually lose their enthusiasm and critical thinking skills. To overcome this, learning must be directed towards a contextual and problem-based approach that actively involves students, so that they are able to connect mathematical concepts with real situations.(Hidayatulloh et al., 2025).

Learning approaches that link local culture, such as ethnomathematics, have been shown to be effective in helping students understand mathematics

better. Ethnomathematics links mathematical concepts to cultural practices, traditional values, and local wisdom that live in the student's community.(Hartono & Wardana, 2025). Integrating cultural elements such as batik patterns, traditional number systems, traditional architecture, and folk games makes learning more relevant and meaningful for students. Students not only understand the material, but also realize that mathematics is part of their lives and cultural identity. This approach encourages active student participation, fosters pride in their own culture, and deepens conceptual understanding through real social experiences.(Arum, 2025).

The way students understand the world, learn, and think is greatly influenced by local culture, including in mathematics learning. In Padangsidimpuan, the Batak Angkola culture is not only an identity, but also shapes the mindset and perspective of the local community. This is reflected in the weaving motifs, the division of house space, the kinship system, and the concept of numbers in traditional ceremonies.(Harahap, 2020). When these cultural elements are integrated into math lessons, abstract concepts become more tangible and understandable to students. They can recognize geometry, patterns, and calculations in the context of everyday life.(Islamiati & Purnamansyah, 2024). This approach also fosters a sense of self-confidence as part of a community with a rich heritage of local knowledge, while strengthening cognitive connections and appreciation for one's own culture.(Gusti Ningsih et al., 2024).

Although cultural integration in mathematics learning has the potential to improve understanding and relevance, its implementation still faces significant challenges. One of the main challenges is the limitations of teachers in designing materials that integrate local culture appropriately and pedagogically.(Suryaputri et al., 2025). Lack of training and resources makes it difficult for many teachers to process cultural elements into meaningful math problems without sacrificing conceptual accuracy. On the other hand, some students find cultural-based problems difficult because of their lack of experience or direct exposure to the culture. The success of ethnomathematics is not only determined by the presence

of culture in the material, but also by learning strategies that are able to combine culture and mathematical concepts effectively.(Iswadi & Sondari, 2025). Therefore, strengthening students' cultural literacy and improving teachers' abilities are important so that learning can reach both cognitive and affective aspects optimally.(Payadnya et al., 2025).

The lack of in-depth investigation into the problems experienced by students in understanding mathematical problems related to culture is a significant inhibiting factor in the development of ethnomathematics, in addition to various implementation obstacles faced. Most studies focus on the influence on conceptual understanding and achievement, but how students process problems with cultural elements at the mental level is still rarely discussed.(Febrianingsih et al., 2024). In fact, recognizing obstacles such as incompatibility between cultural symbols and mathematical representations, ambiguous contexts, or lack of cultural understanding is essential to designing adaptive and contextual learning. Without careful study, teachers tend to only add cultural elements superficially without knowing or addressing the misunderstandings experienced by students. Therefore, comprehensive research is needed that explores how students understand and internalize cultural values in mathematics, as a basis for developing more appropriate learning strategies.(Nurmala et al., 2025).

This study was conducted to fill the gap in the study of students' cognitive difficulties in understanding culturally based mathematics problems, focusing on grade VB students at SD Negeri 200117 Padangsidimpuan. The researcher compiled mathematics problems that combined elements of Batak Angkola culture, a local culture that is full of meaning and symbols, in order to explore how students understand and solve them. This study used a qualitative descriptive approach to examine the thinking process, common mistakes, and conceptual obstacles experienced by students, rather than simply looking at the final results. These findings aim to provide a real picture of the difficulties faced by students, so that teachers can develop learning strategies that are more appropriate to the cultural context. With this approach, ethnomathematics is positioned as a relevant

and applicable pedagogical basis in elementary education.

In line with the spirit of the Independent Curriculum which emphasizes differentiated, contextual learning, and is centered on student uniqueness, the ethnomathematics approach based on local culture is becoming increasingly relevant.(Trisnani et al., 2024). This curriculum requires teachers to include students' social and cultural contexts so that the learning process feels more meaningful and inclusive. In this context, this study formulates the main question: What are the difficulties experienced by fifth grade students in solving Batak Angkola culture-based mathematics problems? This question aims to explore not only technical challenges, but also students' cognitive and affective processes when faced with culturally charged problems. The findings of this study are expected to be a solid foundation for improving teaching methods in accordance with the principles of the Merdeka Curriculum and deepening education based on local cultural values.

## RESEARCH METHODS

### *Research Design*

This study applies a descriptive qualitative method to explore in detail the various types of obstacles faced by grade VB students at SD Negeri 200117 Padangsidimpuan when working on mathematics problems integrated with cultural elements. This approach was chosen because it allows researchers to observe and interpret students' subjective realities comprehensively, including the dynamics of understanding, cognitive barriers, and thinking strategies used when interacting with contextual problems that reflect cultural elements. By not being limited to numbers or quantitative results, this approach opens up space for the disclosure of students' complex thinking processes that are influenced by their socio-cultural backgrounds. This statement is in line with the findings of other studies that adopt a qualitative descriptive approach to examine Bugis ethnomathematics motifs, and highlight the importance of understanding symbolic meanings and cultural values in the mathematics learning process.(Aras et al., 2025). In addition, the qualitative descriptive approach is considered effective in exploring students' thought patterns

when they follow a learning model that integrates traditional games full of cultural values as a learning medium. (Arisetyawan et al., 2025).

***Preparation and Validation of Questions***

This study uses a series of contextual mathematics questions as the main tool, which are specially designed with reference to Batak Angkola cultural elements, such as patterns on ulos cloth, traditional house structures, and inheritance systems in local customs. The question preparation process is carried out in three strategic stages: (1) identification of local cultural elements that are relevant to mathematical concepts such as patterns, symmetry, measurement, and plane shapes; (2) designing question narratives that integrate cultural contexts with basic mathematics competency indicators for grade V in a coherent and communicative manner; and (3) content validity testing through expert judgment by two mathematics lecturers and one senior teacher. This validation aims to assess the suitability between cultural context, competency objectives, and student understanding, and to ensure that the questions produced are not only culturally content, but also pedagogically and mathematically. The approach in designing evaluation instruments based on ethnomathematics is used to measure the extent to which students' critical thinking skills develop.(Munawarah et al., 2025), Content validity is strengthened through an approach that emphasizes the role of experts in the instrument validation process, to ensure that the content is appropriate to the measurement objectives.(Ulya et al., 2024). With this systematic and theory-based process, the resulting instrument is expected to be able to represent the relationship between culture and mathematics authentically and valid in content.

***The Role of Researchers as the Main Instrument***

In the context of qualitative research, researchers play a central role as the main instrument that is actively involved in the entire research process, from planning, data collection, to analysis and drawing meaning from the data obtained. This role not only requires technical involvement, but also sensitivity to the social

and cultural dynamics of participants, especially in studies that emphasize local contexts such as ethnomathematics. In this study, researchers developed observation and interview guides as tools, but still prioritized instinctive sensitivity, empathy, and reflective ability so that the approach in the field can be adjusted to the needs and characteristics of students. Flexibility and adaptability are crucial in dealing with complex and unexpected situations. This statement is in accordance with the concept in qualitative research which emphasizes that researchers are not only silent observers, but also become part of the social system being studied, so that their presence also influences the research process.(Creswell & Poth, 2016). This study highlights the importance of integrity and critical reflection skills of researchers during the qualitative research process, and emphasizes the need for a flexible approach so that the meanings revealed from participants' experiences are authentic and appropriate to the actual context.(Ma'arif & Samiyah, 2024).

***Data collection technique***

Data collection in this study was conducted through three main complementary techniques to gain a complete understanding of students' difficulties in solving mathematics problems based on local Batak Angkola culture. The three complementary data collection techniques are direct observation carried out when students are working on problems to record facial expressions, thinking strategies, and verbal and non-verbal responses, in order to reveal how students interpret cultural symbols in a mathematical context. Semi-structured interviews were conducted with students and teachers to explore understanding, learning experiences, and cognitive barriers while working on contextual problems. Meanwhile, the analysis of artifacts on students' answer sheets aims to identify errors, solution patterns, and the relationship between mathematical concepts and local culture. These three techniques are designed in an integrated manner so that the results obtained are not only descriptive, but also reflect students' learning experiences in their cultural context.

***Data Validation***

To ensure the validity and credibility of the findings in this study, the data validation process was carried out systematically using three main complementary strategies. First, the researcher applied triangulation of sources and time by comparing information from various sources such as students and teachers, while collecting data at different times, in order to minimize bias. Second, direct confirmation was carried out with participants (member check), where students and teachers were given the opportunity to review and correct the results of data interpretation, so that the meaning drawn truly represented their experiences. Third, the researcher involved peer debriefing, namely a reflective discussion with fellow researchers who were not directly involved in data collection, to test logic, interpretation, and possible bias in the analysis process. This method is in line with the basics of reliability in qualitative studies that have been explained.(Naeem et al., 2023), which highlights the urgency of implementing verification procedures such as triangulation, participant checking, and peer review as a foundation. Similar practices also show that the use of triangulation and peer debriefing techniques in an integrated manner can strengthen the credibility of interpretations in culture-based educational research.(Chakma & Li, 2025).

***Data analysis***

In this study, data were analyzed using thematic analysis method chosen because of its advantages in organizing qualitative data into rich and deep patterns of meaning. The initial stage involved making complete transcripts of interviews and field notes obtained while students were working on questions related to Batak Angkola culture. Next, the data were narrowed down by selecting information that was appropriate and supported the research objectives. The next step involved coding students' statements or answers that reflected the type of difficulty, way of thinking, or response to cultural elements in the questions. The codes that emerged were then grouped into broader categories, such as conceptual errors, difficulties in understanding cultural context, or obstacles in connecting cultural narratives to mathematical representations. From these categories, the researcher formulated

main themes that reflected the most striking and analytically important phenomena.

The interpretation process involves breaking down each theme narratively, then connecting it to constructivist learning theory and ethnomathematics frameworks, in order to uncover the deeper meaning behind students' learning experiences. This approach is in line with thematic analysis which emphasizes the reflective and iterative process of finding meaning from data.(Braun & Clarke, 2021). Previous research shows that thematic analysis is very effective in ethnomathematics studies, by examining qualitative data from observations and interviews in depth to identify students' difficulties in learning geometric concepts based on local cultural values.(Kyeremeh et al., 2025). Similarly, the use of thematic analysis to explore students' perceptions of the Chinese cultural context in arithmetic sequence problems, which yielded meaningful findings in the context of cultural and mathematical literacy.(Putri et al., 2024).

## RESULTS AND DISCUSSION

### *Research Findings: Data Overview of Student Difficulties*

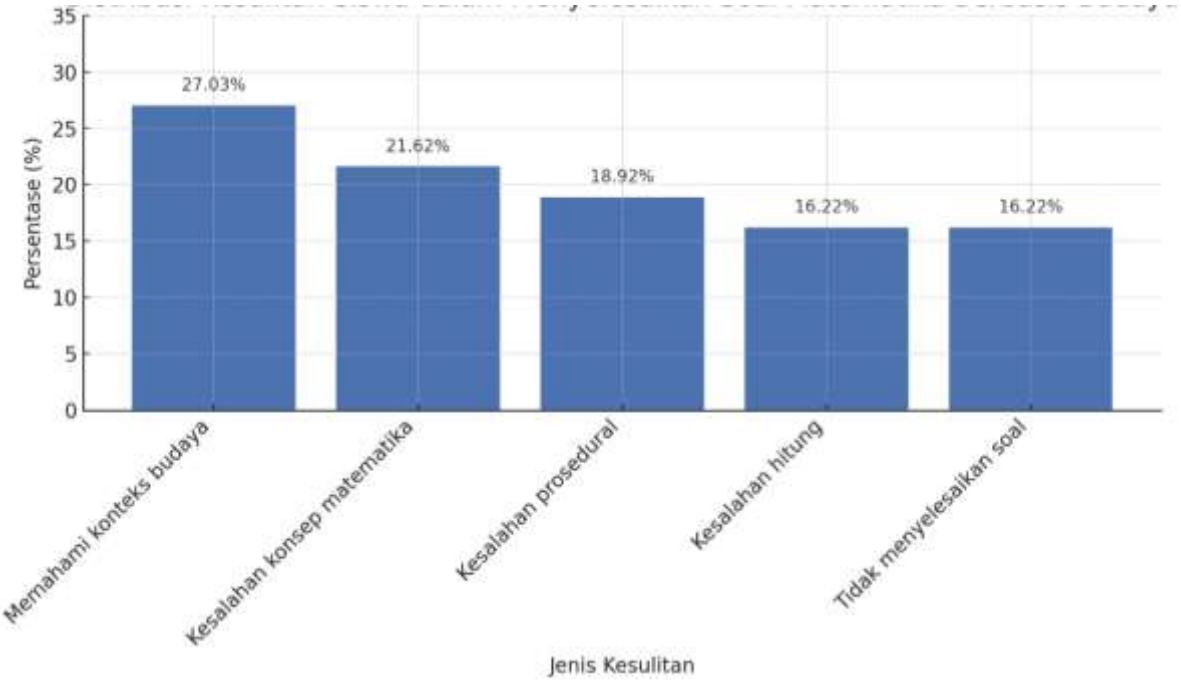
This study involved 37 students of class VB SD Negeri 200117 Padangsidimpuan. Based on the analysis of answer sheets, classroom observations, and interviews, five main categories of difficulties were found that students experienced when working on mathematics problems based on Batak Angkola culture.

**Table 1. Distribution of Student Learning Difficulties**

| No | Type of Difficulty | Number of Students | Percentage (%) |
|---|---|---|---|
| **1** | Difficulty understanding cultural context | 10 | 27.03% |
| **2** | Mathematical misconceptions | 8 | 21.62% |
| **3** | Procedural error | 7 | 18.92% |
| **4** | Miscalculation | 6 | 16.22% |
| **5** | Did not complete the question | 6 | 16.22% |
| | **Total** | **37** | **100.00%** |

For further clarification, below is a visualization of the distribution of students' learning difficulties in the form of a bar chart.

**Figure 1. Diagram of Student Learning Difficulties**




The distribution above shows that the difficulty in understanding the cultural context is the most dominant, indicating a lack of students' connection to the local cultural context that is used as the basis for the narrative of the problem. Many students are not familiar with the terms or practices of Batak Angkola customs, such as the division of inheritance or the meaning of ulos motifs. This has an impact on their failure to interpret the meaning of the problem even though the mathematical aspect is simple.

***Data Verification***

To ensure the validity of the findings, three main triangulation techniques were used: Data source triangulation where students who showed confused expressions and verbal confusion during observations also showed misconceptions in written answers and conveyed ignorance of the cultural context during

interviews. Teacher confirmation where the teacher conveyed that, for students, learning with local content could not be fully understood. Although in fact the average student has a Batak Angkola cultural background, the majority of them are accustomed to Indonesian so that they do not understand the Batak Angkola language, customs, traditions, or social systems in their environment. Time triangulation where interviews were conducted on two separate occasions to assess data consistency. Students who experienced obstacles in the first session showed the same tendency in the second session. This finding indicates that the difficulties experienced are persistent and not solely caused by certain conditions at that time.

The results of this triangulation strengthen the principles of credibility and confirmability in the qualitative approach.(Nowell et al., 2017). Thus, the data collected is considered valid as a representation of the learning reality experienced by students.

***Theoretical Reflections and Implications***

Students' difficulties in linking cultural narratives to mathematical concepts reflect that the learning process is not yet fully within the Zone of Proximal Development (ZPD) as proposed by Vygotsky (1978). ZPD describes the range of abilities that students can achieve with the help of others, but in this context, the cultural-based questions presented have not reached their cognitive readiness optimally. This shows that the presence of cultural elements in questions does not necessarily become a tool for understanding if students are not equipped with adequate cultural literacy. In fact, unfamiliar cultural narratives can create new obstacles in mathematical thinking because students have difficulty finding logical connections between the cultural context and the mathematical principles being asked.

In the Situated Cognition perspective proposed by Brown, Collins, and Duguid (1989), conceptual understanding does not develop in a vacuum, but rather through active involvement in the relevant social and cultural environment. This means that the meaning of mathematical concepts will be stronger if it occurs in real situations experienced or known by students. However, if cultural elements

are only presented in the form of symbols or illustrations without contextual reinforcement through joint exploration in class, students will view it as foreign information that is not functional. This condition makes it clear that the importance of cultural integration in learning is not only in the realm of teaching materials, but also in pedagogical strategies that build authentic connections between student experiences and the concepts taught.

This finding is in line with research results(Susiliastini & Sujana, 2022)in Bali and(Gombo, 2024)in Papua, which both show that the effectiveness of culture-based math problems is highly dependent on prior comprehensive cultural learning. In both studies, the ethnomathematics approach proved successful only when students had been introduced to and engaged in dialogue about the cultural values that emerged in the problems, either through exploratory activities, discussions, or class reflections. This means that the success of cultural integration does not only depend on the quality of the problems designed, but more on the readiness of the learning ecosystem that allows students to activate their cultural schemata critically and meaningfully.

Overall, this section shows that students' difficulties do not only stem from cognitive-mathematical aspects, but also from low cultural literacy, as well as a lack of pedagogical support in connecting cultural contexts to problem structures. Therefore, successful ethnomathematics strategies are not just about changing the names in the problems, but about how teachers build cultural understanding and experience as conceptual foundations.

***Discussion: Data Validation***

Data validation is a crucial part in ensuring the reliability of findings in qualitative research. In this study, validation was conducted comprehensively through the approach of source triangulation, technique triangulation, and time triangulation. This strategy is in line with the principle of trustworthiness proposed by Lincoln and Guba (1985), which includes credibility, transferability, dependability, and confirmability. Validation is used to test the consistency of

findings and compare them with the experiences and perceptions of the various parties involved.

Source triangulation was conducted by comparing data from three parties: students, class teachers, and mathematics subject teachers. The results of interviews with students showed difficulties in understanding the cultural context inserted in the questions, such as the Batak Angkola traditional heritage, ulos motifs, and the structure of traditional houses. The class teacher confirmed that these cultural elements had never been taught explicitly in previous learning. Mathematics teachers also stated that they focused more on achieving basic numerical competencies than on integrating cultural contexts.

Technical triangulation was conducted by combining data from field observations, semi-structured interviews, and artifact analysis (student answer sheets). When students showed expressions of confusion and did not complete the questions in the observations, the findings were consistent with the interview results indicating their ignorance of cultural terms. The students' answer sheets showed procedural errors consistent with students' admissions that they were only guessing without understanding the context of the question narrative.

Time triangulation was conducted by conducting observations and interviews in two different sessions. Students who experienced difficulties in the first session showed similar response patterns in the second session. This indicates that the difficulties experienced were not incidental or situational, but rather structured and systemic. This consistency strengthens the dependability dimension of the findings.(Nowell et al., 2017).

The results of this validation are supported by previous research which found that students in Bali experienced an increase in mathematics learning outcomes only after being given explicit exploration of local culture first.(Susiliastini & Sujana, 2022). Without cultural understanding, the integration of cultural-based questions actually creates confusion. Similarly, in Papua it was reported that students experienced misconceptions when asked to solve cultural-

based questions even though they did not recognize the cultural symbols used.(Gombo, 2024).

In the context of ethnomathematics learning, D'Ambrosio (2001) emphasized the importance of cultural experience as a foundation for mathematical thinking. If the cultural context is only used as a decoration for problems without pedagogical support, then the approach becomes shallow and non-functional. The validation findings in this study strengthen this view, where cultural integration without cultural literacy produces new obstacles, not bridges of understanding.

Teacher validation also showed a gap between the expectations of a culture-based curriculum and the reality of implementation in the classroom. Teachers stated that they felt they did not have enough materials or training to teach local cultural contexts mathematically. This confirms the finding that the main obstacle to ethnomathematics lies in the pedagogical capacity of teachers to elaborate culture in a structured way.(Putri et al., 2024).

In addition, validation from students themselves indicated that the narrative of cultural-based questions actually felt "foreign" to them, even though they came from their own culture. This phenomenon indicates an "internal cultural disconnect," which is when students do not experience or recognize cultural practices that are symbolically inherited. This supports the theory that culture must be experienced, not just passively recognized, to be a meaningful source of learning.(Banks & Banks, 1997).

The results of this validation show that students' difficulties in understanding culturally based mathematics problems are not only cognitive or technical problems, but also concern social and cultural affiliations to the material. Even students from the Batak Angkola ethnic group do not immediately have an understanding of the values of indigenous culture if the context is not introduced and experienced actively in life or the learning process.

Thus, data validation in this study not only confirms the technical validity of the findings, but also broadens the understanding that cultural integration in

mathematics learning requires cultural literacy prerequisites. This finding emphasizes the importance of designing pedagogical strategies that not only place culture as a background, but as part of students' mathematical thinking processes.

## CONCLUSION

This study found that the main difficulty experienced by students in solving mathematics problems based on local Batak Angkola culture lies in understanding the cultural context in the problem. As many as 27.03% of students experienced obstacles in linking cultural elements to the mathematical concepts asked. Followed by mathematical concept errors (21.62%), procedural errors (18.92%), and calculation errors and unfinished tasks (each 16.22%). This finding shows that integrating culture into mathematics problems does not necessarily make it easier for students to understand, but instead creates new challenges if not accompanied by the right learning strategy.

Academically, the results of this study provide an important contribution to the development of ethnomathematics approaches at the elementary school level. This study broadens the perspective in contextual learning by showing that cultural aspects do not only function as a background or sweetener for questions, but become substantive components that students need to understand literately. This requires teachers to not only be creative in designing questions, but also to equip students with an understanding of local culture before presenting them in a mathematical context. Thus, this research enriches the literature on culture-based mathematics education and emphasizes the importance of comprehensive pedagogical integration.

The social contribution of this research lies in the effort to revive local cultural values into modern and competency-based classrooms. By making Batak Angkola culture a part of the learning process, students not only gain mathematical understanding, but also strengthen their identity and appreciation for their own cultural heritage. This approach encourages the formation of education that is relevant to the context of students' lives, strengthens the relationship between schools and the social environment, and promotes education that is more inclusive,

humanistic, and rooted in local wisdom.

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