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EXPLORING ETHNOMATHEMATICS-BASED MULTICULTURAL EDUCATION AS A CHILD-FRIENDLY APPROACH IN BANYUMAS: FOCUSING ON MULTIPLICATION AND GEOMETRY

Desi Setiyadi [1*] Ani Rusilowati[2], Trimurtini[3]
[1] Elementary Madrasah Teacher Education, Institut Daarul Qur'an Jakarta, Tangerang City, 15147, Indonesia
[2] Natural Sciences Education, Faculty of Mathematics and Natural Sciences, Universitas Negeri Semarang
[3] Curriculum Development, Department of Educational Sciences and Psychology, Universitas Negeri Semarang
Email: desisetiyadi12@idaqu.ac.id*, rusilowati@mail.unnes.ac.id[2], trimurtinipgsd@mail.unnes.ac.id[3]
* Corresponding Author

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ABSTRACT

The ethnomathematics approach in primary education offers the potential to conceptualize mathematics learning in a contextual, reflective, and culturally based manner. However, the integration of local culture into Indonesia's mathematics curriculum remains sporadic and lacks a systematic structure. This study aims to describe the implementation of ethnomathematics in multicultural education in primary schools in Banyumas, focusing on the use of Ngapak's non-standard units in multiplication operations and the utilization of traditional games such as *engklek* and *dam-daman* in teaching geometry. Using a qualitative approach with a descriptive type, this study involved teachers, students, and school principals from three primary schools in Banyumas. Data were collected through semi-structured interviews, participatory observations, and document analysis, which were then interactively analyzed through data reduction, data presentation, and conclusion drawing. The study results show that: 1) the use of non-standard units such as *unting*, *sangga*, and *selingget* in multiplication operations enriches students' conceptual understanding by linking mathematics to real-life practices such as trade and agriculture, 2) the *engklek* game strengthens geometry concepts through representations of squares, rectangles, and triangles, while the *dam-daman* game contributes to the development of critical thinking, problem-solving skills, and spatial strategies, 3) this study proves that the ethnomathematics approach not only increases student engagement in learning but also contributes to academic achievement, with mastery levels ranging from 92% to 95% and average scores between 87 and 89.

Keywords: Ethnomathematics, Multicultural Education, Child-Friendly Learning, Multiplication, Geometry

How to cite

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INTRODUCTION

Multicultural education has become a significant focus in the field of education, especially in culturally diverse countries like Indonesia (Setiyadi, 2021). As a response to such diversity, multicultural education seeks to provide an in-depth understanding of cultural (Oktaviana et al., 2023), ethnic, and religious differences (Silva, 2022). Furthermore, the concept of child-friendly schools has been developed in Indonesia to ensure that schools are not only places of learning but also safe, inclusive environments that respect children's rights. Child-friendly school principles encompass the right to feel valued, be free from discrimination, and have equal access to quality education (Fitriani et al., 2020).

However, the implementation of multicultural education at the elementary school level, particularly in Banyumas, including at SD MJK, still faces various complex challenges. Preliminary observations in several elementary schools in Banyumas indicate that multicultural learning remains largely superficial, focusing only on surface-level cultural aspects such as language and traditional symbols, without substantial integration into other disciplines, particularly mathematics. In reality, culture extends beyond language and verbal expressions; it also encompasses social practices and local traditions that can be adapted as pedagogical instruments. Traditional games, as an integral part of cultural heritage, hold significant potential in supporting context-based learning, including in mathematics instruction. For instance, traditional games such as engklek and dam-daman not only represent historical and social values but also contain mathematical structures that can be linked to geometric concepts and numerical operations. This connection contributes to students' conceptual understanding of mathematics in a more applied and contextual manner.

The integration of culture into mathematics learning is known as ethnomathematics, a pedagogical approach that connects mathematical principles with local cultural practices (Setiyadi & Muttaqin, 2024). Ethnomathematics enhances the relevance and applicability of learning materials to students' authentic experiences (Nur et al., 2020), thereby strengthening critical thinking, problem-solving skills, and spatial reasoning within the context of mathematics. Although this approach has a strong theoretical foundation, its implementation in elementary education remains limited and lacks systematic structuring (Rizkyh & Setiyadi, 2023). Therefore, a more comprehensive strategy is needed to reformulate an ethnomathematics-based curriculum, particularly by utilizing traditional games and local cultural practices. This would create a more holistic and meaningful learning experience that aligns with students' cognitive and affective needs.

In the context of elementary education in Banyumas, research on multicultural education and child-friendly schools has been conducted. However, few studies have specifically examined the integration of multicultural education, ethnomathematics, and child-friendly schools simultaneously (Setiyadi, 2021). While the importance of multicultural education in elementary schools is acknowledged, little attention has been given to how mathematical

instruction can be adapted to the local cultural context (Kolovou, 2023). Research into the role of ethnomathematics in education often overlooks how it could contribute to creating child-friendly schools that respect students' cultural diversity (Acharya et al., 2021). This indicates a gap between the concepts of multicultural education (Setiyadi, Munjaji, et al., 2022) and ethnomathematics within the framework of child-friendly schools (Setiyadi et al., 2024).

Additionally, although many schools in Banyumas have embraced child-friendly school principles, observations show that the teaching approaches used are often conventional. Teachers tend to employ uniform teaching methods, with limited consideration for students' cultural backgrounds, especially in mathematics (Setiyadi, Fortuna, et al., 2022). This approach results in local culture students feeling less emotionally and intellectually engaged in the learning process, contradicting the inclusivity principles of child-friendly schools (King, 2022). This gap highlights the need for further research on how ethnomathematics can serve as a tool to strengthen multicultural education within a child-friendly school framework.

The use of ethnomathematics in mathematics teaching can enhance student engagement (Sunzuma et al., 2021), yet existing studies mainly address cognitive aspects and do not explore how ethnomathematics can support more inclusive multicultural learning. Incorporating local culture into teaching could make students feel more valued and motivated (Mpuangnan & Ntombela, 2024) though such studies are often limited to mathematics (Pang et al., 2021).

Interviews with fourth-grade teachers at SD Negeri MJK Banyumas reveal that many teachers understand the importance of multicultural education but find it challenging to integrate it into more technical subjects like mathematics. One fourth-grade teacher noted, "We want to make lessons more relevant to students' lives, but we're unsure how to connect mathematics with local culture." This underscores an urgent need to provide training and resources for teachers so they can develop ethnomathematics-based approaches that align with multicultural education and child-friendly school principles.

The statement from the school principal highlights an ongoing challenge: while there have been efforts to implement the child-friendly school concept, the systematic integration of local culture into the learning process remains inconsistent. This gap underscores the complexity of aligning educational practices with cultural context, particularly in subjects like mathematics, which are often perceived as more technical and abstract. Despite these challenges, several elementary schools in Banyumas, such as SD Negeri MDN, SD Negeri PGN, and SD Negeri BGN, have made significant strides in incorporating ethnomathematics into their teaching practices. These schools have adopted the use of non-standard Ngapak units of measurement, particularly for multiplication, and have integrated traditional games like engklek and dam-daman to teach geometric concepts. By bridging local cultural practices with mathematical content, these schools are pioneering an innovative approach that aligns academic learning with students' cultural identities, helping them see the relevance of mathematics in their everyday lives.

This application of ethnomathematics in these schools demonstrates a meaningful connection between mathematical concepts and local cultural practices, which can substantially enhance students' understanding and engagement. Traditional games such as engklek and dam-daman not only provide a fun and interactive way to explore geometric shapes, but they also ground abstract mathematical ideas in familiar, culturally relevant contexts. By using these local

cultural tools, the schools create a learning environment where students are more likely to relate to the material, making it easier for them to grasp complex mathematical concepts. Moreover, this approach increases students' motivation, as they are able to see how their cultural heritage is valued and incorporated into their education, which fosters a more inclusive and culturally responsive learning atmosphere. As a result, this method not only supports conceptual understanding but also cultivates a deeper sense of connection to both their education and their cultural background.

This study aims to describe the implementation of ethnomathematics in multicultural education at elementary schools in Banyumas, particularly in the use of Ngapak non-standard units for multiplication and traditional games in teaching geometry. This study not only describes the teaching practices that have been implemented but also assesses how this approach influences students' conceptual understanding of mathematics and their motivation to learn. By connecting mathematical concepts with local culture, this research seeks to demonstrate how ethnomathematics can make learning more contextual and engaging for students.

The findings of this study are expected to serve as a foundation for developing a more systematic, local culture-based curriculum, making mathematics instruction more relevant and aligned with the principles of child-friendly schools. Additionally, the results of this research can serve as a reference for other elementary schools interested in implementing ethnomathematics in their teaching practices. Thus, this study contributes not only to theoretical development but also provides practical recommendations for teachers and policymakers in creating more inclusive and culturally responsive mathematics education.

METHODS

This study adopts a qualitative approach with a descriptive method to describe the implementation of ethnomathematics in the context of multicultural education at elementary schools in Banyumas. The primary focus of this study is on the use of Ngapak non-standard units in multiplication instruction and the utilization of traditional games as teaching tools for introducing geometric concepts. This approach aims to gain a deep understanding of the learning process, which integrates local cultural values into mathematics instruction, and its impact on students' conceptual understanding and motivation to learn.

By focusing on multiple schools, this study aims to provide in-depth insights into the practices used by teachers, the challenges they encounter, and how the concept of ethnomathematics is applied in daily learning. This research was conducted on fourth-grade students in several elementary schools in Banyumas, Central Java, Indonesia, specifically at SD Negeri MDN, SD Negeri PGN, and SD Negeri BGN. These locations were selected due to the rich local cultural heritage in Banyumas, which has the potential to be integrated into ethnomathematics-based learning, such as *engklek* and *dam-daman*. Additionally, the schools are located near traditional markets, where students are accustomed to helping their parents prepare agricultural products for sale. Furthermore, several elementary schools in the area have begun implementing child-friendly school principles, although this is still in the early stages.

The research subjects include fourth-grade teachers, fourth-grade students, and school principals. Data collection techniques involved interviews conducted with teachers, students, and principals. Semi-structured interviews were chosen to allow for an in-depth exploration of participants' perspectives while maintaining a structured framework. The interviews include: 1) Classroom teachers as fourth-grade the primary source for understanding the implementation of ethnomathematics in the context of multicultural and child-friendly schools, 2) Fourth-grade students who participate in ethnomathematics-based learning, providing insights into their views on local culture-based learning, 3) School principals to understand school policies related to the implementation of multicultural and child-friendly education principles within the curriculum.

Participant observation was conducted to directly observe the implementation of ethnomathematics in teaching and how students respond to this method. The observation covered aspects such as teaching methods, learning materials used, and the interaction dynamics between teachers and students. Additionally, it examined the extent to which child-friendly school principles are incorporated into teaching practices. Documentation, such as curriculum materials, learning modules, and school policies, was analyzed to assess the formal integration of multicultural education and ethnomathematics within the curriculum. Teaching resources used in mathematics classes were also collected to evaluate the extent of ethnomathematics application in instruction. Data analysis followed a structured process, including data collection, data display, data reduction, and conclusion drawing.

RESULT AND DISCUSSION

Integrating local cultural values into the mathematics curriculum through ethnomathematics not only makes learning materials more relevant but also encourages students to perceive the connection between mathematics and their everyday lives. In Banyumas, this approach is implemented through traditional games and unique local measurement units, such as *dam-daman*, *engklek*, and Ngapak non-standard units, fostering active student engagement in the learning process.

Based on observations conducted at SD Negeri MDN, the ethnomathematical approach is implemented through the integration of traditional games into mathematics learning, particularly through the games of *dam-daman* and *engklek*. These games not only serve a recreational function but also act as instructional tools that enable students to construct conceptual understanding related to fundamental mathematical principles such as measurement, patterns, and problem-solving strategies. In the context of *engklek*, the spatial structure formed by the square-based playing area explicitly represents various geometric shapes, including squares, rectangles, and triangles. Thus, this game serves as a medium for students to gain direct experience in identifying the fundamental characteristics of geometric figures before transitioning to more abstract symbolic representations in the formal mathematics curriculum.

The implementation of ethnomathematics-based learning through *engklek* follows an exploratory and constructivist approach, where students are encouraged to observe, identify, and reflect on the connections between game elements and basic geometric concepts. The

teacher acts as a facilitator, guiding students in analyzing the geometric configurations that emerge in the game while helping them extract the underlying mathematical principles. This process is reinforced through analytical questioning, prompting students to compare the properties of squares and rectangles, explore the relationships between sides and angles, and investigate how triangles can be formed from subdivisions of other geometric figures within the engklek pattern.

Observations indicate that this method enhances students' active engagement in the learning process while optimizing the connection between conceptual understanding and concrete experiences within the local cultural context. Thus, integrating traditional games as representations of ethnomathematics not only enriches students' learning experiences but also contributes to strengthening a more contextual, reflective, and applicable understanding of mathematics.

Figure 1. Students Playing *Engklek* and *Dam-Daman*

During these observations, social interactions among students were prominent. Students learned to respect each other's opinions and collaborate in groups. Teachers also noted that these games enhance students' mathematical skills as well as their social and emotional competencies. A particularly important observation was the boost in self-confidence among students, especially those who had previously been more reserved, as they were encouraged to share their gameplay strategies with the class.

Figure 2. Students Measuring the Length of the *Engklek* Game Area

At SD Negeri BGN and SD Negeri 2 PGN, observations focused on the use of Ngapak's unique non-standard measurement units in mathematics lessons. In this context, teachers employed Ngapak units (Setiyadi, 2023), as illustrated in Table 1, to explain multiplication concepts. Students were actively involved, measuring classroom objects using these culturally contextual units. During observations, students demonstrated high enthusiasm as they measured items independently, indicating strong engagement in the learning process.

Table 1. Unique Ngapak Banyumas Non-Standard Measurement Units

No.	Item	Measurement Unit	Description
1	Spinach, Melinjo Leaves	*Unting* = 1 small bundle 10 *unting* = *sesangga*	Measurement for vegetables, where an *unting* equals one adult handful of spinach tied with bamboo string.
2	Petai	*Semata* = 1 petai bean *Sekeris* = 1 petai strand 10 *keris* = *selingget* 20 *keris* = *segedheng* 2 *lingget* = *segedheng*	Specific units for petai; bamboo string is used for bundling.
3	Corn	*Selas* = 1 corn kernel *Sejanggel* = 1 corn cob 10 *janggel* = *sepocong*	Measurement for corn, where *sepocong* is 10 cobs with husks, tied together with bamboo string.
4	Rice	*Selas* = 1 rice grain *Sekuthuk* = 0.5 kg *Sebekong* > 1 kg	*Sekuthuk* is a measurement using a small coconut shell cup, and *sebekong* is made from large *maja* fruit or a big coconut shell.
5	Tofu	*Seiris* = 1 tofu slice 10 *iris* = *sejinah*	*Sejinah* consists of 10 tofu slices placed together in plastic.
6	Coconut	*Glunthung* = 1 coconut *Segada* = 100 coconuts	
7	Plant Groupings	*Dapuran pring*: a grouping of bamboo plants in one location *Dapuran wit gedhang*: a grouping of banana plants in one location	*Dapuran* refers to a collection of the same plant species growing together in one area.

The teacher provided clear instructions to students on using non-standard units and helped them understand the relevance of these units in everyday life. A teacher from SD Negeri PGN stated,

> "*We teach students how to use local units such as* unting, sekeris, selingget, *and* seglunthung *for measurement. They find it easier to grasp these concepts because they frequently use them at home.*" (INT is a teacher from SD Negeri PGN)

Discussions among students revealed that they were already familiar with using non-standard units within their families, such as for measuring harvested crops. A teacher from SD Negeri BGN explained,

> *"When we asked how they measure agricultural products, students immediately mentioned units like* unting, sejanggel, *and* sebekong. *This makes them more enthusiastic about learning because they feel that mathematics is directly connected to their daily lives."* (SRI is a teacher from SD Negeri BGN)

Additionally, interviews with teachers from the three schools revealed that they believe an ethnomathematics-based approach can significantly enhance students' understanding of mathematics. The fourth-grade teacher at SD Negeri MDN stated,

> *"Through traditional games such as engklek and dam-daman, students not only learn mathematical concepts such as patterns and measurement but also social values like cooperation and honesty."* (EST is a teacher from SD Negeri MDN)

This approach also received support from the school principal. The head of SD Negeri MDN stated,

> *"Integrating local cultural values into learning makes students more enthusiastic and feel more connected to the material being taught. Teachers have observed that culture-based learning is more effective than conventional methods." (BMB is* The head of SD Negeri MDN)

Overall, the ethnomathematics approach not only helps students understand mathematics in a more contextual manner but also strengthens their connection to local culture and social values in everyday life. However, some teachers also noted challenges in implementing this method. For instance, they acknowledged that it can sometimes be difficult to find enough time within the packed curriculum to carry out more creative and interactive activities. This suggests that, while there is great potential in implementing ethnomathematics, there is a need for a more flexible curriculum that allows for the use of innovative teaching methods.

The interviews conducted with fourth-grade students at SD Negeri MDN provided comprehensive insights into the dynamics of learning motivation in the context of primary education. Students demonstrated significant enthusiasm for learning activities that incorporated games and experiences relevant to their daily lives. One student mentioned that dam-daman was a favorite activity because it allowed them to learn mathematical concepts interactively and enjoyably. This statement indicates that experiential and contextual learning approaches have positive implications for increasing student engagement in the learning process. Furthermore, integrating traditional games into mathematics instruction contributes to the internalization of academic concepts through more practical and communicative mechanisms.

From a theoretical perspective, learning motivation is a psycho-pedagogical construct influenced by various intrinsic and extrinsic factors. Several studies over the past five years have identified key indicators affecting student motivation in primary education. Learning motivation is determined by several factors, including the desire for academic success, intrinsic drive for learning, expectations for academic achievement, recognition of effort, the appeal of learning activities, and a conducive learning environment (Purwanti & Pujiastuti, 2020). Furthermore, Muliadi et al., (2022) emphasized that enjoyable learning experiences can enhance self-efficacy and students' cognitive engagement in the learning process. In this context, the integration of traditional games such as dam-daman in mathematics instruction aligns with several of these

motivational indicators, particularly in increasing the appeal of learning activities and fostering a more supportive learning environment. The implementation of game-based learning models not only enhances student engagement but also contributes to the development of meaningful, reflective, and applicable learning experiences. Thus, this approach can serve as an effective pedagogical strategy to optimize learning motivation and the internalization of academic concepts in primary education.

A student, AFN, from SD Negeri BGN expressed that counting with unting was easier than using the jarimatika method. Students could visually see how many objects they were counting. This statement reflects a better understanding of multiplication concepts when students can relate it to their everyday experiences. On the other hand, interviews with the school principals revealed full support for the implementation of ethnomathematics-based education. The principal of SD Negeri MDN expressed confidence that education should consider the cultural context of students. Therefore, the school fully supports the teachers' initiatives to integrate ethnomathematics into the curriculum. Learning resources are provided in Table 2.

Table 2. Learning Resources Links

No	School Location	Link
1	SD Negeri BGN	https://www.youtube.com/watch?v=NffKgq_otQk
2	SD Negeri 2 PGN	https://www.youtube.com/watch?v=c-blhBsPohM

The principal of SD Negeri BGN plans to continue developing a more culturally-based curriculum and ethnomathematics approach and to hold training for teachers to improve their teaching skills using this approach. This shows the school management's commitment to creating a learning environment that better supports students. The documentation analyzed in this study includes learning modules reflecting the implementation of ethnomathematics, observation notes, and school activity documentation. The learning modules at all three schools show that teachers have designed activities that clearly integrate local values and traditional games into mathematics teaching. At SD Negeri MDN, the module includes activities for the dam-daman game, designed to help students understand concepts of strategy and patterns in mathematics. These activities are planned in small groups to enhance social interaction. At SD Negeri BGN and SD Negeri 2 PGN, the modules in these two schools include activities for measuring using non-standard Ngapak units, emphasizing hands-on experience. The documentation shows that students were actively engaged in the measurement process and class discussions.

At SD Negeri MDN, students demonstrated an understanding of pattern and measurement concepts through the dam-daman game. The teacher explained,

> *"Students are not just playing, but they also analyze the steps they take. Some students can explain how a certain pattern is more effective for winning, which shows that they have understood strategic and pattern concepts in the game while also linking them to mathematical concepts."* (EST Teacher SD Negeri MDN)

Furthermore, the teacher observed that students who previously lacked confidence in mathematics became more actively involved due to the contextual learning method, which was closely related to their daily lives.

Meanwhile, at SD Negeri PGN, students were given the task of measuring length and area using non-standard Ngapak units, such as *sekeris* and *sejanggel*. In practice, students not only performed measurements but also compared their results with peers and discussed the differences that emerged. The teacher stated,

> *"We asked them to measure the classroom table using local units, and they immediately engaged in discussions. They began to understand that while non-standard units can be used, there is a need for uniformity in measurement to ensure consistent results." (*INT Teacher SD Negeri PGN)

This discussion illustrated that students not only grasped the fundamental concept of measurement but also started to think critically about the limitations and advantages of non-standard units compared to standard ones.

At SD Negeri BGN, an ethnomathematics-based approach was also evident in how students reflected on their learning. The teacher revealed that students were asked to record their measurement results using traditional units and draw diagrams to compare object sizes in various units. The teacher explained,

> *"We saw that students started thinking more deeply. They did not just write down numbers but also attempted to illustrate concepts visually, provide reasons for measurement differences, and discuss how non-standard units are relevant in everyday life."* SRI is a teacher from SD Negeri BGN)

From this, it was clear that students were not merely memorizing mathematical concepts but were also able to explore and connect their learning to real-life situations in their surroundings. To support the analysis of these achievements, documentation in the form of student work photos was also collected as concrete evidence of their learning progress. These photos show how students illustrated dam-daman game patterns, recorded measurement results using non-standard units, and compared their results with standard units.

At SD Negeri BGN, the use of non-standard units in mathematics learning had a positive impact on student test results. The average test score of fourth-grade students reached 89, with a learning completion rate of 93%. Students successfully answered questions measuring their understanding of non-standard units like unting and sangga. This result shows that students were able to understand and apply the measurement concepts in their cultural context and perceive the relevance of mathematics in daily life.

Test results at SD Negeri 2 PGN also showed promising progress. The average mathematics test score of fourth-grade students at this school was 87, with a learning completion rate of 92%. Students demonstrated good progress in answering questions related to measurement and mathematical applications. Students were able to accurately measure objects around them using the non-standard units that had been taught.

Overall, the results of the daily tests on multiplication and geometry material obtained from the three schools indicate that the implementation of ethnomathematics-based learning contributes positively to improving students' conceptual understanding of mathematics. The use of non-standard Ngapak units in multiplication operations, along with the incorporation of traditional games like engklek and dam-daman in geometry learning, allows students to relate mathematical concepts to their everyday lives. The results from the daily tests show that

students not only gain a deeper understanding of mathematical concepts but are also able to apply these concepts in a more relevant and contextual setting.

Active student involvement in activities involving local culture, as reflected in the application of traditional games, has enriched their learning experience. Learning that incorporates cultural elements not only makes the learning process more enjoyable but also enhances students' retention of the material. For example, through the engklek game, students gained a better understanding of basic geometric shapes such as squares, rectangles, and triangles. This type of learning is not only theoretical but also based on practical experiences that improve students' memory and understanding of the geometric concepts being taught.

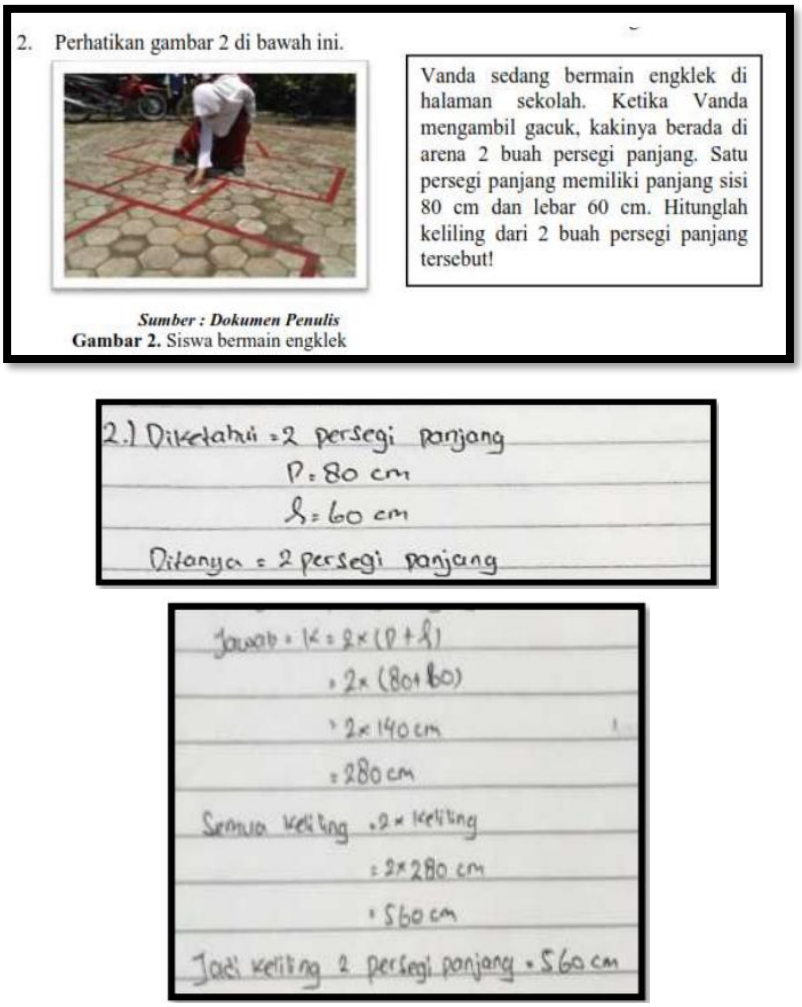

Figure 3. Questions and Answers

The analysis of problems based on the engklek game shows that integrating culture into mathematics learning can enhance student engagement and strengthen their understanding of mathematical concepts. By connecting learning with direct experiences, students not only learn to calculate perimeter abstractly but also understand how the concept applies to real-life situations. This confirms that ethnomathematics-based learning is not only effective in improving learning outcomes but also in building connections between mathematics and local culture, which is closely related to students' daily lives.

Furthermore, the integration of ethnomathematics into the curriculum is expected to continue to evolve as an effort to create a more inclusive and contextual learning environment for students. By combining a culture-based approach, mathematics learning becomes more relevant and meaningful for students, as they can see a direct connection between mathematical concepts and their daily lives. Therefore, the application of ethnomathematics has the potential to enrich students' learning experiences while also improving their academic achievement in mathematics. Figure 4 below the learning outcomes based on ethnomathematics in the daily tests on multiplication (SD Negeri BGN and SD Negeri PGN) and geometry (SD Negeri MDN).

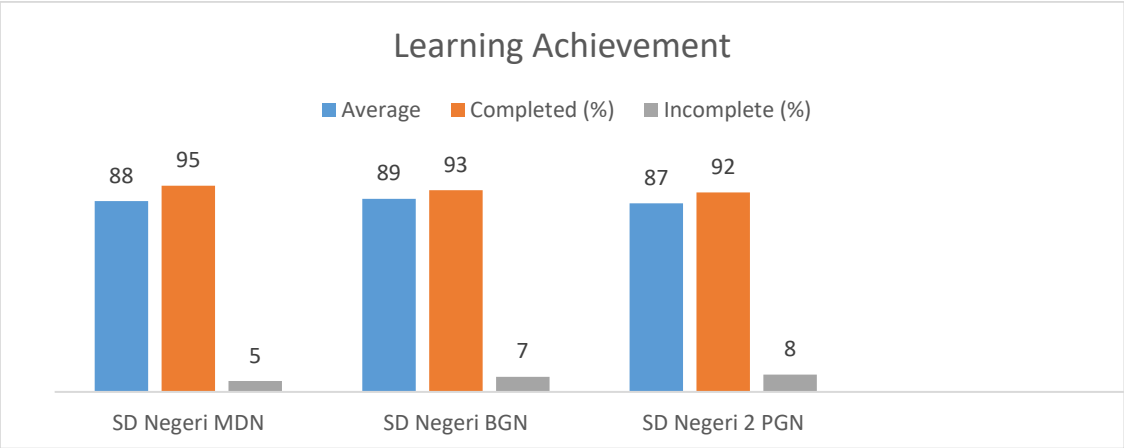

Figure 4. Learning Achievement of Each School

The implementation of ethnomathematics-based learning in elementary schools in Banyumas is a promising innovation in addressing the challenges of mathematics education, which is often perceived as difficult and irrelevant to students' daily lives. Ethnomathematics, as an approach that integrates culture and local values into mathematics education , has been proven effective in increasing students' motivation and learning outcomes (Harding, 2021). Culturally-based learning not only strengthens the understanding of mathematical concepts but also fosters a sense of ownership and relevance for students toward the material being taught (Polman et al., 2021). Ethnomathematics provides students with the opportunity to apply the mathematical knowledge they already possess in their social and cultural contexts (Prahmana, 2022).

In Banyumas, the application of ethnomathematics is carried out through methods that link the learning material to traditional games, such as dam-daman and engklek. At SD Negeri MDN, for example, these games are not only used as learning tools but also as a means to introduce mathematical concepts like measurement and patterns. Students involved in ethnomathematics-based learning through traditional games have shown significant improvement in understanding mathematical concepts, especially in measurement and strategy (Pan & Ke, 2023). This finding suggests that direct interaction with local culture can create more enjoyable and meaningful learning experiences for students.

Meanwhile, at SD Negeri BGN and SD Negeri 2 PGN, the use of non-standard Ngapak units in teaching mathematics has also had a significant positive impact. The use of non-standard

units makes it easier for students to understand the concept of measurement, as they can relate the values they are learning to their daily experiences (Setiyadi, 2023). The results of the tests show that students in both schools achieved high average scores of 88 and 87, with learning completion rates of 95% and 92%. This indicates that students not only understand the material but also apply it to real-life situations.

The success of ethnomathematics-based learning can also be seen in the involvement of students in the learning process. Culturally-based approaches not only enhance learning motivation but also strengthen students' active participation in the classroom (Mulianti et al., 2023). In Banyumas, this involvement is reflected in dynamic group discussions where students exchange ideas and experiences related to the material being taught. This collaborative learning experience allows students to learn from one another, building critical and creative thinking skills.

However, the implementation of ethnomathematics is not without challenges, particularly related to teachers' readiness to integrate local culture into the curriculum. The importance of training teachers to understand and effectively implement ethnomathematics is crucial (Mania & Alam, 2021). Without adequate professional support and development, teachers may struggle to create relevant and engaging learning experiences for students (Haug & Mork, 2021). Therefore, collaboration between schools, the government, and the community is essential to create an environment that supports the application of ethnomathematics in education (Turmuzi et al., 2023).

The implementation of ethnomathematics in Banyumas also contributes to the development of students' character. By understanding and appreciating local culture through learning, students not only become more competent in mathematics but also more aware of their cultural identity. This aligns with the national educational goals of creating a generation that is not only academically intelligent but also has a sense of pride in their culture and environment. In this context, ethnomathematics can serve as a bridge between formal education and local culture, creating a more holistic learning experience (Harding, 2021).

The use of the Ngapak dialect in primary school education reflects an effort to nurture cultural closeness while preserving local identity amidst the tides of modernization. This dialect, with its unique vocabulary and expressions, brings a vibrant nuance to learning (Gkartzios et al., 2020), especially when applied in cultural contexts such as ethnomathematics. When students grasp mathematical concepts through traditional games like dam-daman or multiplication using the unique units of the Ngapak culture, they are not merely learning but also feeling a sense of cultural acknowledgment. This process creates a profound emotional experience, boosting learning enthusiasm and instilling pride in their heritage (Grund et al., 2024).

On the other hand, Indonesian as the instructional language plays a pivotal role in ensuring students can compete in both national and global contexts. In this regard, bilingual teaching can serve as an effective approach. Teachers may begin lessons in the Ngapak dialect to foster comfort and teach concepts within a local context. Subsequently, Indonesian can be used to expand students' knowledge and help them connect these concepts to the broader world (Sumarni et al., 2022). This strategy not only strengthens students' communication skills in both languages but also trains them to think flexibly and adaptively (Hwang et al., 2022).

This approach aligns with Edgar Dale's cone of experience theory (Yulifar & Aman, 2023), which underscores the importance of direct experiential learning before progressing to abstraction (Wang et al., 2021). The Ngapak dialect allows students to experience tangible learning through familiar daily activities, while Indonesian broadens their understanding to a more abstract and universal level. Through this combination, students not only learn concepts but also feel valued as individuals with a unique cultural identity (De Jong et al., 2023), fostering a more humane and meaningful education (Alam, 2022).

Overall, the research findings show that the implementation of ethnomathematics-based learning in elementary schools in Banyumas not only improves students' understanding of mathematical concepts but also strengthens their cultural identity and increases their involvement in the learning process. These findings have important implications for curriculum development and educational practices in Indonesia, encouraging the integration of local values into education to create a generation that is not only competent in science but also connected to their cultural heritage.

CONCLUSION

Based on research data obtained through observations, interviews, and documentation at SD Negeri MDN, SD Negeri BGN, and SD Negeri 2 PGN, it can be concluded that: 1) the use of non-standard units such as unting, sangga, and selingget in multiplication operations enriches students' conceptual understanding by linking mathematics to real-life practices such as trade and agriculture, 2) the engklek game strengthens geometry concepts through representations of squares, rectangles, and triangles, while the dam-daman game contributes to the development of critical thinking, problem-solving skills, and spatial strategies, 3) this study demonstrates that the ethnomathematics approach not only increases student engagement in learning but also contributes to academic achievement, with mastery levels ranging from 92% to 95% and average scores between 87 and 89.

These findings indicate that culturally responsive learning not only strengthens students' conceptual understanding of mathematics but also enhances their motivation and participation in the learning process. However, this study has several limitations, such as the lack of follow-up efforts to assess the long-term impact of ethnomathematics on students' critical thinking and problem-solving skills. Additionally, this study has not yet explored the application of similar approaches to other mathematical topics at higher grade levels. Therefore, further research is recommended to explore broader teaching models, integrate technology into ethnomathematics-based learning, and evaluate its effectiveness in diverse educational contexts to ensure a sustained impact on the quality of mathematics education.

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