



The Impact of Ethnomathematics Application on Mathematics Learning Achievement in Fourth Grade at SD Negeri 02 Bekonang

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Abstract

This study aims to investigate the impact of implementing ethnomathematics on mathematics learning outcomes among fourth-grade students at SD Negeri 02 Bekonang. The research employs a quantitative method with an experimental approach, involving a population of 44 students from classes IV (A) and IV (B). The students were divided into two groups: the experimental class, which applied ethnomathematical concepts through the traditional game engklek, and the control class, which learned without incorporating ethnomathematical concepts. The findings indicate that the experimental class achieved higher post-test scores compared to the control class. The average post-test score for the experimental class was 64.55, while the control class scored 51.82. The t-test analysis yielded a significance value of $0.037 < 0.05$, demonstrating a significant influence of ethnomathematics on students' mathematics performance. The ethnomathematical approach, which integrates cultural elements into learning, has proven to be an effective strategy in mathematics education. This approach not only enhances students' conceptual understanding but also makes learning more engaging and meaningful. In this study, the engklek game was used as a learning medium to introduce the concept of geometric shapes, allowing students to grasp the material more easily through direct experience. Therefore, this approach is recommended for mathematics instruction in elementary schools to foster student engagement and comprehension. This study also encourages teachers to be more creative in developing concrete and contextually relevant teaching methods, ensuring that mathematics is no longer perceived as a daunting subject.

INTRODUCTION

Mathematics learning in elementary schools should be based on students' cognitive development. The lack of students' understanding of geometric shapes at SD Negeri 02 Bekonang serves as the background for this study. Many students experience confusion and difficulty in learning basic geometry concepts due to teaching methods that are predominantly theoretical and lack real-world experience.

As a result, students tend to have low learning outcomes, particularly in the study of geometric shapes [1].

The ethnomathematical approach, which integrates cultural elements into mathematics learning, can be applied and implemented as an alternative to enhance students' mathematical understanding. In this study, ethnomathematics is introduced through the traditional game *engklek*. This game incorporates geometric elements such as squares, rectangles, and trapezoids, helping students recognize and comprehend geometric shapes more concretely [2]. Additionally, *engklek* fosters social interaction and increases students' interest in learning [3].

Observations at SD Negeri 02 Bekonang revealed that most teachers rarely use engaging teaching media in mathematics lessons. Students are often taught geometric concepts theoretically, without direct involvement in exploratory activities. This condition makes it difficult for students to connect mathematical concepts with real-life applications [4].

Previous research also supports the effectiveness of ethnomathematics in improving students' knowledge and learning outcomes. A study by Febriyanti et al. [5] found that the traditional game *engklek* enhances students' spatial thinking skills. Similarly, research by Nurniyati et al. [6] demonstrated that a culture-based approach to mathematics increases students' motivation to learn.

Findings from relevant online journal articles further support the idea that ethnomathematics positively impacts students' academic performance. For instance, research by Batubara [7] shows that culturally based learning media can actively engage students in the classroom. Additionally, a study by Permatasari [8] highlights that integrating cultural elements into mathematics helps students grasp abstract concepts more concretely.

Another study by Rafiah et al. [9] identified that ethnomathematics-based learning fosters critical and analytical thinking while enhancing students' conceptual understanding of mathematics. Additionally, Fitriyah & Khaerunisa [10] found that traditional games incorporating mathematical elements can boost students' creativity in solving problems during lessons.

This study employs an experimental approach by comparing post-test results between the experimental class, which applied ethnomathematical concepts, and the control class, which did not. A total of 44 fourth-grade students from SD Negeri 02 Bekonang were selected as samples, with 22 students in the experimental class engaging in *engklek* as a learning medium for geometric shapes, while the other 22 students in the control class used conventional classroom-based learning media [11].

Statistical data analysis revealed a significant difference between the post-test results of the experimental and control classes. The average post-test score of the experimental class was 64.55, whereas the control class only reached 51.82. The t-test analysis indicated a significance value of $0.037 < 0.05$, confirming that the

ethnomathematical approach significantly influenced students' understanding of geometry concepts [12].

The novelty of this study lies in the implementation of *engkelek* as a mathematics learning medium, which has rarely been utilized in elementary school environments. Unlike previous research that primarily explored the relationship between ethnomathematics and culture, this study demonstrates how traditional games can serve as effective teaching tools to enhance students' understanding of geometry [13].

Furthermore, this research contributes to the development of more contextual and experiential learning media. The findings provide valuable insights for teachers in designing more innovative and engaging instructional methods for students [14]. This study highlights ethnomathematics as an effective solution to address students' low comprehension of geometric shapes. Integrating traditional games into mathematics learning can enhance student motivation, participation, and academic performance [15]. As an implication of this study, schools are encouraged to adopt culturally based teaching methods to improve the effectiveness of mathematics education. Additionally, teachers should receive more in-depth training on incorporating ethnomathematics into the elementary school curriculum [16].

METHODS

This study adopts a quantitative method with an experimental approach to examine the effectiveness of mathematics learning through the application of ethnomathematics using the traditional game *engkelek*. The research population consists of fourth-grade students from SD Negeri 02 Bekonang, with a total sample of 44 students. The control class consists of Class IV (A), while Class IV (B) serves as the experimental class. The experimental class applies the ethnomathematical approach through *engkelek*, whereas the control class uses conventional classroom-based learning.

The data collection instruments in this study include multiple-choice questions to assess students' understanding and mathematics learning outcomes, as well as documentation of the learning process to enhance data accuracy. Data analysis was conducted through a series of statistical tests, including a normality test to ensure data distribution, a homogeneity test to examine the variance similarity between groups, and a t-test to determine whether there was a significant effect of the independent variable between the experimental and control groups. This analysis process was supported by SPSS software, facilitating accurate and efficient data processing.

The ethnomathematical approach in mathematics learning has proven effective in enhancing students' knowledge and understanding of geometric shapes. A study by Maulida et al. [17] developed an innovative mathematics teaching module based on ethnomathematics using the traditional game *engkelek*. The study demonstrated that integrating local culture into learning makes the material more relevant to learning

objectives and easier for students to comprehend. Furthermore, research by Wahyuningsih and Astuti [18] identified that *engklek* incorporates mathematical concepts such as geometry, counting, probability, similarity, and congruence, which can be integrated into lessons to improve students' understanding of these topics.

The implementation of traditional games like *engklek* in mathematics education not only enriches teaching methods but also plays a role in preserving local culture. By incorporating cultural elements into the learning process, students become more motivated and gain a deeper mastery of the material due to its relevance to real-life experiences. Additionally, ethnomathematics helps students develop critical and analytical thinking skills through contextual problem-solving. Therefore, integrating ethnomathematics into elementary school mathematics proves to be an effective strategy for enhancing educational quality and fostering students' cultural awareness.

RESULTS AND DISCUSSION

Research Findings

The implementation of ethnomathematics in fourth-grade mathematics learning at SD Negeri 02 Bekonang is described as follows:

In the control class, the learning process was conducted using the Problem-Based Learning (PBL) method. The lesson began with the teacher delivering material on geometric shapes using a supplementary textbook. The teacher explained the fundamental concepts, including shapes, properties, perimeter formulas, and area calculations of geometric figures. Students listened to the teacher's explanation and took notes on key points. No ethnomathematical concepts were applied in this class.

Next, students were divided into small groups for problem-based learning activities. Each group was assigned the task of drawing a specific geometric shape and listing its properties. They were also asked to write down the formulas for perimeter and area. This group activity encouraged discussion and collaboration among students to reinforce their understanding of the material.

In the experimental class, the same Problem-Based Learning (PBL) approach was used, but with the integration of ethnomathematical concepts. One of the key activities involved using the traditional game *engklek* as a learning medium. Students played a modified version of *engklek*, where each square in the game represented a specific geometric shape. This interactive and engaging approach aimed to provide meaningful learning experiences.

Students in the experimental class were also divided into small groups. However, unlike the control class, they not only drew geometric shapes but also cut and pasted images related to the *engklek* game as part of their learning activities. This approach allowed students to go beyond memorizing formulas by directly interacting with the learning medium, helping them grasp the properties and characteristics of geometric shapes more effectively.

Both the control and experimental classes were given multiple-choice tests to assess their understanding of the material. The post-test consisted of the same number of questions for both groups, serving as a measurement tool to compare the effectiveness of the teaching methods used. The results of the post-test revealed a significant difference in learning outcomes between the two groups. The experimental class demonstrated a greater improvement in understanding, highlighting the effectiveness of ethnomathematics-based learning.

Control Class	Control Experimental Class
<div>1. Problem-Based Learning (PBL) model implementation</div> <div></div>	<div>1. Problem-Based Learning (PBL) model implementation</div> <div></div>
<div>2. Group-based activities</div> <div></div>	<div>2. Group-based activities</div> <div></div>
<div>3. Use of supplementary textbooks</div> <div></div>	<div>3. Ethnomathematics using the <i>engklek</i> game</div> <div></div>



Control Class	Control Experimental Class
<p>4. Post-test</p> 	<p>4. Post-test</p> 

Figure 1. Learning Activities in the Control and Experimental Classes.

The research instrument in the form of multiple-choice questions was tested for validity and reliability before being applied in this study. The validity test results showed that five questions were valid, while the other five were not. The valid questions were used in this study to analyze students' understanding of plane geometry material.

The reliability test results, indicate that the multiple-choice questions have a Cronbach's Alpha coefficient greater than 0.60. The Cronbach's Alpha value for the multiple-choice questions is 0.618, which is higher than the minimum threshold of 0.60, indicating that the questions are reliable. Therefore, these multiple-choice questions can be used as a research instrument.

The prerequisite test results showed that the normality test using the Shapiro-Wilk test revealed that the post-test data from both the control and experimental classes were normally distributed, with a significance value above 0.05. The homogeneity test results indicated that both groups had the same variance (homogeneous).

The hypothesis test using the t-test was conducted to determine the significant effect of applying ethnomathematics on mathematics learning outcomes. The t-test results showed a significant positive difference between the experimental and control groups, with a significance value of 0.037, which is less than 0.05.

The average post-test score of the experimental class increased compared to the control class. This indicates that the use of ethnomathematics in mathematics learning has a positive impact on students' understanding. The Influence of Ethnomathematics in Learning has been shown to enhance student engagement in the learning process.

Discussion

Students who learn by applying the traditional game *engklek* show greater enthusiasm compared to those who use conventional methods. Fitriyah & Khaerunisa [20] stated that learning based on traditional games can enhance students' learning motivation. Research by Nurniyati et al. [21] shows that the ethnomathematics approach contributes to improving students' ability to solve problems. Students who learn through traditional games are more active in analyzing mathematical problems.

In this study, students who learned using ethnomathematics experienced improvements in both cognitive and affective aspects. Rafiah et al. [22] stated that students find it easier to understand concepts when they are linked to daily experiences. The application of ethnomathematics aligns with the experience-based learning approach recommended in the *Merdeka Curriculum*. According to Permatasari [23], an experience-based approach enables students to connect learning with real-life situations.

Local culture can serve as an effective learning medium to enhance students' understanding of mathematics. Nova & Putra [24] found that incorporating cultural elements in learning increases student engagement and motivation. Research findings indicate that students who use ethnomathematics show significant improvement in their scores compared to those using conventional methods. Rosikhoh et al. [25] demonstrated that the implementation of ethnomathematics enhances elementary school students' understanding of geometry.

Learning through the *engklek* game allows students to interact and work in groups. According to Budiana et al. [26], collaborative learning contributes to a better understanding of mathematical concepts. Some students experience difficulty in connecting mathematical concepts with traditional games. However, with practice, their understanding improves. Irin & Prasetyo [27] found that active student involvement in culture-based learning enhances comprehension. This study highlights the importance of teacher training in implementing ethnomathematics. Darmayanti et al. [28] suggested that teachers need to develop innovative strategies for teaching mathematics using cultural contexts. The application of ethnomathematics has proven to improve students' learning outcomes in plane geometry. These findings align with research by Risdiyanti & Prahmana [29], which shows that traditional games strengthen elementary school students' understanding of mathematical concepts.

CONCLUSION

The results of this study indicate that the application of ethnomathematics through the *engklek* game has been proven to significantly improve the post-test mathematics scores of fourth-grade students at SD Negeri 02 Bekonang. The concept of ethnomathematics is not only effective in enhancing students' understanding of mathematical concepts but also makes learning more enjoyable and interactive. By linking mathematical concepts with familiar traditional games, students find it easier to grasp the material and become more engaged in the learning process. This approach also helps students develop logical thinking skills while improving their motor and social skills through peer interaction.

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