

Ethnomathematics Exploration of the Traditional Game of Kites in Geometry Learning in Elementary Schools

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Abstract

This study aims to explore ethnomathematical concepts in the traditional kite game and integrate them into geometry learning in elementary schools. The traditional kite, as part of Indonesia's local cultural heritage, embodies various geometric concepts such as plane figures (kite, triangle, square), symmetry, angles, diagonals, perimeter, and area. This research employs a descriptive qualitative approach using observation, interviews, and documentation techniques. The findings indicate that the structure and construction process of kites can serve as meaningful real-life contexts for understanding the properties of plane figures and the relationships among geometric elements. The integration of ethnomathematics through traditional games has been shown to enhance students' conceptual understanding, increase learning motivation, and foster appreciation for local culture. This culturally based learning approach also supports contextual teaching aligned with the cognitive development characteristics of elementary school students. Therefore, the exploration of ethnomathematics in traditional kite games has strong potential as an innovative alternative for meaningful, engaging, and relevant geometry instruction in elementary education.

Keywords: ethnomathematics, kite, geometry, contextual learning, elementary school.

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Introduction

Mathematics learning in elementary school plays a fundamental role in developing students' logical, critical, and systematic thinking skills. However, various studies over the past decade have shown that mathematics learning, particularly geometry, tends to be abstract and lacking context, resulting in poor conceptual understanding. Geometry is often taught through procedural and symbolic approaches without connecting concepts to students' real-life experiences. This condition results in low learning motivation and students' inability to apply geometric concepts in everyday life (Parmiyanti & Rismawati, 2023; Devian et al., 2024).

One relevant approach to bridging this gap is ethnomathematics. The concept of ethnomathematics was first introduced by Ubiratan D'Ambrosio, who emphasized that mathematics is inseparable from the cultural context of society. In recent studies, ethnomathematics is understood as the integration of local cultural practices with formal mathematical concepts in schools. This approach enables students to understand mathematics as part of their own social and cultural lives (Kurino et al., 2022; Winardi & Jupri, 2025). In this way, learning becomes more meaningful, contextual, and is able to foster appreciation for local wisdom.

Indonesia, a culturally rich country, boasts a variety of traditional games steeped in mathematical concepts. These games serve not only as a means of recreation but also possess educational and philosophical value. Various studies over the past decade have shown that folk games, traditional architecture, crafts, and even local cuisine contain geometric elements such as symmetry, transformation, plane shapes, and spatial shapes (Octaviani & Mariana, 2023; Agustian et al., 2025). Therefore, exploring local culture as a source for learning mathematics is a strategic step in supporting context-based 21st-century learning.

One of the most popular traditional games in various regions of Indonesia is the kite. Structurally, a kite has a flat shape that represents the concept of a quadrilateral, with two pairs of equal sides and one pair of equal opposite angles. Furthermore, it incorporates the concepts of diagonals, line symmetry, rotational symmetry, circumference, and area. The kite-making process also involves measuring length, comparing, and understanding proportions. This demonstrates that the traditional kite game has great potential as a contextual medium for geometry learning in elementary schools.

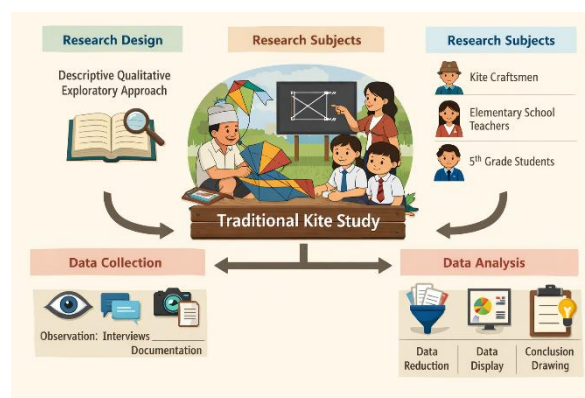
Recent research shows that the integration of ethnomathematics in geometry learning can significantly improve students' conceptual understanding. Parmiyanti dan Rismawati (2023) found that the application of ethnomathematics to geometry material increased the engagement and learning outcomes of elementary school students. In line with that, Devian et al. (2024) stated that traditional games based on ethnomathematics are effective in strengthening conceptual connections between mathematics and students' real experiences. In fact, a systematic literature study by Winardi dan Jupri (2025) emphasized that the ethnomathematics approach contributes positively to students' critical thinking skills and conceptual understanding.

In the context of research on learning development in elementary schools, Ike Kurniawati (2022; 2024) emphasized that integrating local culture into mathematics learning tools can improve the quality of the learning process and strengthen students' character through the introduction of local wisdom values. Besides that, Dedi Apriansah (2021; 2023) in their study of innovations in mathematics learning in elementary schools, they stated that culturally context-based learning can increase students' motivation and active engagement in understanding geometric concepts. These findings reinforce the urgency of exploring ethnomathematics in the context of traditional games. Furthermore, national education policy also encourages character-based learning and local culture as part of strengthening the Pancasila Student Profile.

The integration of ethnomathematics in kite-flying not only supports the achievement of cognitive competence in geometry, but also instills the values of cooperation, creativity, precision, and a love of national culture. Thus, learning is not only oriented towards mastering concepts, but also towards the formation of students' character. Based on this description, it can be concluded that the exploration of ethnomathematics in traditional kite-flying has strong academic and pedagogical urgency. This approach has the potential to be an innovation in geometry learning that is contextual, meaningful, and relevant to the lives of elementary school students. Therefore, this research is important to identify and describe the geometric concepts contained in kite-flying and examine their implementation in mathematics learning in elementary schools.

Research Method

This study uses a descriptive qualitative approach with an exploratory design to identify and describe geometric concepts contained in traditional kite games and examine their integration into mathematics learning in elementary schools. The research subjects included kite craftsmen, elementary school teachers, and fifth-grade students studying plane geometry. Subjects were selected using purposive sampling based on their involvement in cultural practices and the learning process. Data collection techniques were carried out through observation, interviews, and documentation in the form of photographs, field notes, and learning tools. Data analysis included data reduction, data presentation, and drawing conclusions. The following are the research steps illustrated in the figure.



Pic 1. Steps Qualitative Research Design's

Result and Discussion

The results of the study indicate that traditional kite games contain various geometric concepts relevant to elementary school materials, particularly on the topic of plane figures. Based on observations of the kite-making process and structure, it was found that the basic shape of the kite represents a quadrilateral with two pairs of equal sides, a pair of equal opposite angles, and diagonals that intersect at right angles. In addition, there are concepts of line symmetry, rotational symmetry, circumference, area, and relationships between plane figure elements such as vertices, sides, and diagonals. During the assembly stage, the craftsman determines the balance point by measuring the length of the bamboo frame and the position of the rope, which implicitly involves the concepts of comparison and proportion. This activity indicates the existence of informal mathematical practices that live in the community's culture, as emphasized by D'Ambrosio that mathematics is a result of social construction that develops in a cultural context (D'Ambrosio, 2001).

When the context of kite-flying games is integrated into geometry learning in the classroom, students show a more active and enthusiastic response compared to learning that only uses textbooks. Students observe the shape of the kite directly, measure the length of the sides using a ruler, determine the diagonal, and calculate the perimeter and area based on the real-world data they obtain. This process helps students build conceptual understanding gradually from the concrete to the abstract. This finding aligns with Parmiyanti dan Rismawati (2023) which states that ethnomathematics-based learning is able to increase the involvement and understanding of elementary school students' concepts. Devian et al. (2024) also emphasized that traditional games studied through an ethnomathematics perspective are effective in strengthening the connection between mathematical concepts and students' real experiences.

Interviews with teachers showed that using a local cultural context made it easier for students to understand the properties of geometric shapes because they were already familiar with the shape and function of kites in everyday life. Students no longer saw geometry as a collection of formulas, but rather as part of an activity closely related to their experiences.

This condition strengthens the findings Kurniawati (2022) which states that the integration of local culture into mathematics learning tools can improve the quality of the learning process while fostering student character through the introduction of local wisdom values. In this study, students demonstrated cooperative attitudes during discussions, precision when measuring, and a sense of pride in their traditional regional games. This shows that learning not only impacts cognitive aspects, but also affective and social aspects. Pedagogically, the integration of ethnomathematics through kite games supports a contextual learning approach that is appropriate to the cognitive development stage of elementary school students who are still at the concrete operational stage. Students need real objects to understand abstract concepts such as diagonals, angles, and symmetry. By using kites as a contextual medium, teachers can bridge concrete experiences to the generalization of formal concepts. This finding is also in line with Apriansah (2023) which states that cultural context-based mathematics learning can increase students' motivation and active participation in understanding geometric concepts.

Theoretically, the results of this study strengthen the position of ethnomathematics as a relevant approach in elementary education because it is able to integrate local cultural practices with the formal curriculum. Practically, this study shows that the traditional kite game has the potential to be an innovative alternative in geometry learning that is meaningful, fun, and relevant to students' lives. This integration not only improves conceptual understanding but also supports character building and appreciation of local culture as part of national identity. Thus, the exploration of ethnomathematics in kite games can be seen as a pedagogical strategy that is not only contextual, but also transformative in mathematics learning in elementary schools. The mapping of geometric concepts in kite games is presented in Table 1.

Table 1. Mapping Geometry Concepts in Traditional Kite Games

No	Activities in Kite Games	The Geometry Concepts Contained	Implementation in Elementary School Learning	Student Understanding Indicators
1	Observing the basic shape of a kite	Flat shapes: kites, quadrilaterals	Identifying the properties of shapes through direct observation	Mention the characteristics of a kite
2	Measuring the length of the bamboo frame	Length of sides, pairs of sides of equal length	Measuring and comparing side lengths using a ruler	Determine pairs of sides that are the same length
3	Determining the frame meeting point	Diagonals and intersection points	Drawing diagonals and observing the relationships between diagonals	Understanding that diagonals are perpendicular to each other
4	Balancing the rope position	Fold symmetry and proportion	Folding a paper model to find the axis of symmetry	Shows the line of symmetry correctly
5	Calculating the circumference of the frame	Perimeter of a flat shape	Add up all the lengths of the sides	Calculate the circumference correctly

No	Activities in Kite Games	The Geometry Concepts Contained	Implementation in Elementary School Learning	Student Understanding Indicators
6	Determining the area of the cover paper	Area of a flat shape	Divide the shape into two triangles and calculate their area	Calculate the area based on the correct formula

The mapping table shows that each activity in the traditional kite game has a clear correspondence with formal geometric concepts in elementary school. This relationship between cultural activities and mathematical concepts strengthens Ubiratan D'Ambrosio's view that mathematics is a social construction that arises from the cultural practices of society. In this context, the process of measuring bamboo, determining the balance point, and calculating the area of the paper covering the kite are forms of informal mathematics that can be reconstructed into formal concepts such as sides, diagonals, symmetry, circumference, and area. This finding is in line with research Parmiyanti dan Rismawati (2023) which shows that ethnomathematics-based geometry learning helps students understand the properties of flat shapes through real experiences, so that the concept is no longer merely abstract and procedural.

In addition, the mapping in the table also shows that the integration of traditional games into learning supports the improvement of students' conceptual understanding indicators. Devian et al. (2024) found that the use of folk games as a learning context can strengthen the connection between everyday experiences and formal mathematical structures. This is reinforced by Kurniawati (2022) which emphasizes that integrating local culture into mathematics learning tools not only improves the quality of the learning process but also fosters student character and motivation. Thus, the table not only presents a classification of activities and concepts, but also provides empirical evidence that kite flying can serve as an effective contextual medium for building a meaningful and sustainable understanding of geometry.

Conclusion

Based on the research results, the traditional kite game contains geometric concepts relevant to elementary school mathematics, including shape properties, diagonals, symmetry, perimeter, and area. Integrating this cultural context into learning helps students understand geometry more concretely through direct observation, measurement, and calculation. These findings confirm that local cultural practices can be transformed into meaningful ethnomathematics-based learning that strengthens conceptual understanding, learning motivation, and appreciation of local culture. Future research is needed to examine the long-term effects of this approach on students' academic achievement and to explore its adaptation across different cultural and regional contexts.

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