EMTEKA: Jurnal Pendidikan Matematika
Volume 6, No. 1, 2025. 433-443
DOI: https://doi.org/10.24127/emteka.v6i1.7819

e-ISSN 2746-5594
p-ISSN 2746-5608

EXPLORATION OF THE ETHNOMATHEMATICS OF *MAGGALE* AND *MAJJEKKA* AS CULTURAL HERITAGE OF TRADITIONAL BUGIS GAMES

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Received 28 February 2025; Received in revised form 26 March 2025; Accepted 27 March 2025

ABSTRACT
This study explores the mathematical concepts and cultural values embedded in the traditional games *maggale* and *majjekka*, which are still preserved by the Bugis community. It aims to understand how these games integrate mathematical principles such as geometry, basic physics, and probability with cultural values, including solidarity, creativity, and tradition preservation. Using a qualitative approach with an ethnographic design, this research provides an in-depth analysis of the cultural phenomena under study. Data collection was conducted through direct observation, in-depth interviews with players, community leaders, and game equipment makers, as well as visual documentation in photos and videos. The techniques employed include participatory observation, semi-structured interviews, and visual documentation. The collected data were analyzed descriptively and thematically to identify and interpret the mathematical concepts and cultural values embedded in these games. To ensure validity, source triangulation, member checking, and thick description were used to maintain consistency and reliability. The findings reveal that these games incorporate mathematical concepts such as surface area, volume, ratio, similarity, probability, and the relationship between distance, speed, and time. Additionally, they reflect the cultural values of the Bugis community, such as solidarity, creativity, and the preservation of traditions. These results highlight that traditional games serve not only as entertainment but also as contextual learning tools aligned with the educational curriculum and as a medium for cultural preservation. To ensure sustainability, *maggale* and *majjekka* should be integrated into formal education, cultural events, and digital documentation. This research significantly contributes to ethnomathematics-based mathematics education and local cultural preservation.
Keywords: ethnomathematics; local culture; maggale; majjekka; traditional game.

ABSTRAK
Penelitian ini berfokus pada eksplorasi konsep matematika dan nilai budaya yang terkandung dalam permainan tradisional maggale dan majjekka, yang masih dijaga kelestariannya oleh masyarakat Bugis. Studi ini bertujuan untuk memahami bagaimana permainan tersebut mengintegrasikan prinsip-prinsip matematika seperti geometri, fisika dasar, dan probabilitas dengan nilai-nilai budaya, termasuk kebersamaan, kreativitas, dan pelestarian tradisi. Dengan menggunakan pendekatan kualitatif berdesain etnografi, penelitian ini memungkinkan analisis mendalam terhadap fenomena budaya yang dikaji. Pengumpulan data dilakukan melalui observasi langsung, wawancara mendalam dengan pemain, tokoh masyarakat, serta pembuat alat permainan, serta dokumentasi visual dalam bentuk foto dan video. Teknik yang digunakan mencakup observasi partisipatif, wawancara semi-terstruktur, dan dokumentasi visual. Data yang diperoleh dianalisis secara deskriptif dan tematik untuk mengidentifikasi serta menafsirkan konsep-konsep matematika dan nilai budaya dalam permainan tersebut. Keabsahan data dijamin melalui triangulasi sumber, member checking, dan thick

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e-ISSN 2746-5594
p-ISSN 2746-5608

description guna memastikan konsistensi serta validitas temuan penelitian. Hasil penelitian mengungkap bahwa permainan ini mengandung konsep matematika seperti luas permukaan, volume, perbandingan, kesebangunan, peluang, serta hubungan antara jarak, kecepatan, dan waktu. Selain itu, permainan ini merefleksikan nilai-nilai budaya masyarakat Bugis, seperti semangat kebersamaan, kreativitas, dan upaya pelestarian tradisi. Temuan ini menegaskan bahwa permainan tradisional tidak hanya berfungsi sebagai hiburan tetapi juga sebagai sarana pembelajaran kontekstual yang selaras dengan kurikulum pendidikan dan sebagai wahana pelestarian budaya di era modern. Untuk mendukung keberlanjutannya, disarankan agar permainan maggale dan majjekka diintegrasikan dalam pendidikan formal, acara budaya, serta didokumentasikan melalui teknologi digital. Dengan demikian, penelitian ini memberikan kontribusi yang berarti dalam pengembangan pembelajaran matematika berbasis etnomatematika serta pelestarian budaya lokal.
Kata kunci: *budaya lokal; etnomatematika; maggale; majjekka; permainan tradisional.*

Introduction

Traditional games are a form of cultural heritage that reflects the identity of a community. *Maggale* is a traditional game that involves strategy and careful calculation, where players must be able to analyze the moves and predict the opponent's moves. In this context, the game provides an understanding of logic, problem solving, and the use of numbers. Games like *maggale* can help students develop critical and analytical thinking skills. Meanwhile, *majjekka* is a game that demands good motor skills and an understanding of space (Alvariani & Sukmawarti, 2022; Maryanti et al., 2021; Setiawan, 2020). In this game, players must be able to manage positions and strategies, which are also closely related to the concepts of geometry and spatial awareness. Traditional games such as *majjekka* not only improve math skills, but also train students to work together and interact socially (Agus et al., 2020; Sartika & Semiaji, 2024).

In this game, coconut shells are fitted with ropes as handles, so that players can stand on coconut shells and walk by maintaining balance In Bugis society, traditional *maggale* and *majjekka* games not only function as entertainment but also as a learning medium that is rich in cultural values and mathematical concepts. As part of local wisdom, these games reflect the creativity of the community in utilizing natural resources, such as coconut shells, to create simple yet meaningful games. However, the development of the times and modernization has led to the diminishing interest of the younger generation in traditional games, including maggale and majjekka. This condition threatens the sustainability of cultural heritage that has great potential in local culture-based education.

The ethnomathematics approach, as proposed by (Rosa & Orey, 2011; Selvianiresa & Prabawanto, 2017), becomes relevant in this context. Ethnomathematics connects culture with mathematics, allowing students to understand mathematical concepts in their cultural context. In *maggale* and *majjekka* games, there are various mathematical concepts, such as geometry, chance, and basic physics, that can be explored to improve students' understanding. For example, the coconut shell shape that resembles a hemisphere can be used to teach the concepts of surface area and volume. In addition, the balancing activity in the game teaches the principle of center of mass, which is relevant to both

e-ISSN 2746-5594
p-ISSN 2746-5608

mathematics and physics concepts. Therefore, this game has great potential to be integrated into contextualized math learning.

Based on the existing literature review, research on the integration of traditional games in mathematics learning is still limited. There are several studies that mention that traditional games can increase student motivation and participation in learning mathematics (Abdul, 2020; Devi, 2024; Rahmasari et al., 2023). This finding is reinforced by several studies that show that an ethnomathematics approach based on traditional games can improve students' creative thinking skills (Merliza, 2021; Ramadhina et al., 2021). However, studies that specifically explore maggale and majjekka games from an ethnomathematics perspective are still very minimal. This indicates a significant analytical gap in existing research, namely the lack of studies on how these two traditional games can be used as a means of teaching mathematical concepts in the context of local culture, especially in Bugis society.

This gap is particularly relevant when linked to the problems in the field, namely the declining interest of the younger generation in traditional games, as well as the challenge of improving students' mathematical understanding in schools. Maggale and majjekka games offer great potential to be effective tools in teaching mathematics contextually. Therefore, this research focuses on developing an ethnomathematics approach that integrates traditional games as learning media, with the aim of reducing the gap between formal education and local culture.

The novelty resulting from this research is the development of a more comprehensive and applicable ethnomathematics approach, by digging deeper into how traditional *maggale* and *majjekka* games can be applied to teach various mathematical concepts. In addition, this research aims to provide a deeper understanding of the cultural values contained in these games and how these values can enrich the mathematics learning process. Using an ethnography-based qualitative approach, this research is expected to make a meaningful contribution to the preservation of local culture as well as to the development of culture-based mathematics learning.

Overall, the results of this study are expected to provide new insights into the importance of integrating traditional games in education, as well as a reference for educators, researchers, and the general public in preserving cultural heritage that is increasingly threatened by modernization. This research is also expected to encourage innovation in learning mathematics that is more contextual, interesting, and relevant to the younger generation.

Research Methods

This study used a qualitative approach with an ethnographic design to explore in depth the mathematical concepts and cultural values contained in traditional *maggale* and *majjekka* games. This design was chosen because it is suitable for exploring cultural phenomena in the context of Bugis society, which still preserves the game. Research data were obtained from various sources, namely direct observation of the implementation of the game, in-depth interviews with key informants, and visual documentation in the form of photos and videos.

The research subjects in this study were Bugis people involved in the implementation of *maggale* and *majjekka* games. Specifically, the research subjects

e-ISSN 2746-5594
p-ISSN 2746-5608

consisted of three main groups: (1) players who are active in both games, (2) community leaders who have traditional knowledge about the games, and (3) game tool makers, who have the skills and understanding of how to make traditional game tools. The selection of research subjects was carried out using purposive sampling technique, where the subjects were selected based on the criteria of their relevance to the game, experience, and understanding of the mathematical concepts and cultural values contained in the game. In addition, to deepen insights, the researcher also conducted snowball sampling, by asking for recommendations from key informants to find other subjects who had significant knowledge or involvement with the game. This approach allowed the researcher to understand the social, cultural, and mathematical context of the game more thoroughly.

Data collection in this study was conducted using various methods. Participatory observation techniques were applied, where researchers directly took part in game activities to identify mathematical patterns and the dynamics of social interactions that emerged. In-depth interviews using semi-structured guidelines were used to dig up information about the origin of the game, the rules that apply, the cultural values contained, and the community's perception of the mathematical concepts in the game. In addition, visual documentation was conducted to support data obtained from observations and interviews, to provide a more comprehensive representation of game activities. Data analysis was done descriptively and thematically. Data obtained from observations, interviews, and documentation were analyzed by sorting, grouping, and interpreting themes relevant to the research objectives. This analysis included the identification of mathematical concepts such as geometry, chance, and basic physics in *maggale* and *majjekka* games, as well as the exploration of cultural values such as togetherness, creativity, and sportsmanship. To ensure data validity, this study used source triangulation, which compares information from different data collection techniques and sources. This technique aims to ensure the consistency and accuracy of the data obtained. In addition, data validity is strengthened by member checking and thick descriptions to ensure that the data obtained is in accordance with the views of the sources and can be understood in a broader context.

Data were collected through direct observation, in-depth interviews, and visual documentation. Observations were conducted to understand the implementation of *maggale* and *majjekka* games, while in-depth interviews with players, community leaders and game tool makers explored their understanding of mathematical concepts and cultural values in the games. Visual documentation in the form of photos and videos was used to record game dynamics and social interactions. Data analysis was conducted using thematic coding to identify key themes, followed by contextual analysis linking the findings to ethnomathematics theory. Source triangulation was used to verify the data and ensure its consistency. These steps aimed to produce valid and reliable data on traditional games and their contribution to mathematics learning and local cultural preservation.

The qualitative approach with ethnographic design in this study allowed for a comprehensive exploration of the phenomenon of traditional *maggale* and *majjekka* games. This method not only resulted in a deep understanding of the mathematical concepts and cultural values contained in the games, but also made a significant contribution to the preservation of Bugis cultural heritage amidst the challenges of

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p-ISSN 2746-5608

modernization. The data obtained is expected to be used to develop ethnomathematics-based mathematics learning and formulate effective strategies to preserve these games in the community.

Results and Discussion

The results of this research were obtained through an in-depth data collection process, including direct interviews with resource persons who understand the traditional games of *maggale* and *majjekka*. In addition, direct observations were made of the implementation of these games in the local community, as well as documentation in the form of photos, videos, and field notes to strengthen the research results.

1. *Math Concepts in Maggale and Majjekka Games*

   The *maggale* and *majjekka* games involve a number of mathematical concepts related to geometry, physics and probability. One such concept is the use of hemispherical shapes in coconut shells, which teaches an understanding of surface area and volume. The surface area is calculated based on the formula of the area of the sphere divided by two, while the volume is obtained from the formula of the volume of the sphere which is also divided by two (Rosa & Orey, 2011; Selvianiresa & Prabawanto, 2017). Illustration of a hollow half-sphere in a coconut shell can be seen in Figure 1.

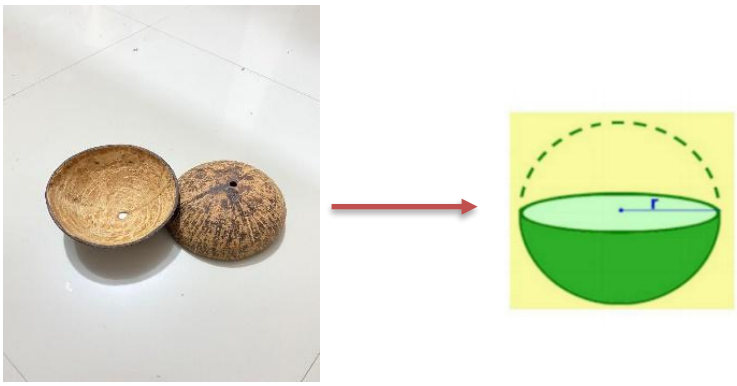

Figure 1. Illustration of a hollow half-sphere in a coconut shell

In addition, the game also involves the principles of balance and center of mass. Players must be able to distribute their body weight over the coconut shell to remain stable. This concept shows the application of physics principles (Febrianty et al., 2023) closely related to children's ability to understand static balance intuitively. The selection of coconut shells also considers the circularity of the base to ensure comfort during play (Abdul, 2020; Devi, 2024; Rahmasari et al., 2023).

2. *Cultural Values in Maggale and Majjekka Games*

The game reflects the cultural values of the Bugis community, such as togetherness, creativity and preservation of traditions. Togetherness can be seen from the social interactions that occur during the game. Children play together in an

e-ISSN 2746-5594
p-ISSN 2746-5608

atmosphere that supports solidarity and cooperation (Rosala, 2016; Widjayatri et al., 2023). Creativity is also reflected in the utilization of coconut shells as the main material for the game. Coconut shells were chosen due to their abundant availability in the Bugis region. According to Pariani & Sarjan (2024), the utilization of local resources like this reflects the community's ability to adapt to their environment. The game is also a symbol of tradition preservation, where the younger generation is introduced to their cultural heritage in the midst of modernization (Basori, 2025; Mahamid, 2024).

3. *Observation of Game Techniques and Activities*

Observations show that *maggale* and *majjekka* games teach motor skills, balance and coordination. Children use coconut shells as footwear and hold a rope to maintain balance. This technique helps them understand the relationship between body movement and weight distribution (Simanjuntak et al., 2023). Children trying out the *Maggale* and *Majjekka* games can be seen in Figure 2.

Figure 2. Children trying out the *Maggale* and *Majjekka* games

In terms of math, observations also show that players naturally learn about step patterns and distance estimation. The hemispherical shape of coconut shells allows children to concretely understand the concepts of circle and space (Oktavimadiana & Nugrahanta, 2022; Simanjuntak et al., 2024). The game not only involves physical aspects but also reinforces social values, where children support each other during the game (Oktavimadiana & Nugrahanta, 2022; Simanjuntak et al., 2024; Simanjuntak et al., 2023).

4. *Documentation and Game Making*

The process of making game tools involves several stages, namely cleaning coconut shells from coarse fibers and coconut meat, providing holes for ropes, and installing 1-2 meters of rope according to the height of the player. This process shows that traditional games can be a medium for contextual learning, where mathematical concepts are applied in everyday life (Panjaitan et al., 2024; Simanungkalit & Saragi, 2023). The process of making *Maggale* and *Majjekka* game tools can be seen in Figure 3.

e-ISSN 2746-5594
p-ISSN 2746-5608

Figure 3. The process of making *Maggale* and *Majjekka* game tools

The results of this study support the ethnomathematics theory which states that mathematics can be found in various aspects of local culture (Hartanti & Ramlah, 2021; Indriaini, 2018; Putri, 2017; Siregar et al., 2024; Zayyadi, 2018). In the context of *maggale* and *majjekka* games, mathematical concepts such as geometry and basic physics are not only part of the game, but also a contextual and relevant learning tool. This finding is also in line with research by (Abdul, 2020; Devi, 2024; Rahmasari et al., 2023), which shows that traditional games can improve students' understanding of mathematical concepts.

The cultural values found in this study, such as togetherness and creativity, also strengthen the findings of previous research. Traditional games not only serve as entertainment, but also as a medium to instill social and cultural values to the younger generation (Saputra et al., 2024; Suryawan, 2020). However, this study provides novelty by integrating hemispherical geometry analysis into the exploration of *maggale* and *majjekka* games, which have not been widely discussed in previous studies. In addition, this study also highlights the potential of these games in developing culture-based learning relevant to the modern curriculum.

There are some findings that contrast with previous research. For example, (Artobatama, 2018; Kiska, 2022; Saputra, 2017) emphasized more on the development of technology-based traditional games to attract the younger generation. In contrast, this study focuses on preserving cultural authenticity through traditional approaches. This shows that the preservation of traditional games can be done with various approaches, both through technology and direct conservation.

Although this study was successful in identifying mathematical concepts and cultural values contained in traditional *maggale* and *majjekka* games, there are several limitations that need to be considered. Firstly, this study was conducted within the Bugis community, which potentially limits the representation of the findings in the context of other cultures or communities with similar game traditions. Therefore, the results of this study may not be fully generalizable to other regions or communities, so further research with a wider and more diverse sample is needed to strengthen these findings.

Secondly, despite direct observation and in-depth interviews, this study may not have fully covered all dimensions of the game, especially in terms of non-verbal aspects or physical precision involved in the game, such as body balance regulation. This may affect a deeper understanding of the application of mathematical and

e-ISSN 2746-5594
p-ISSN 2746-5608

physical principles in game practice, which can be more complex and varied than recorded in the documentation.

Third, although the results of the study indicate the potential of *maggale* and *majjekka* games as contextualized mathematics learning tools, their application in formal educational contexts has not been tested in depth. This study has not examined the extent to which the games can be effectively integrated in a broader and more structured educational curriculum. Therefore, further research is needed to explore the potential implementation of these games in formal education settings and evaluate their impact on learning.

In addition, this study has not assessed the long-term impact of children's involvement in these games on the development of math skills and other social aspects. Therefore, further research is needed to explore whether these traditional games have a significant and sustainable impact on the cognitive, social and emotional development of the children involved.

Conclusion and Suggestion

This study aims to explore the mathematical concepts, cultural values, and preservation strategies of the traditional games *maggale* and *majjekka* as a Bugis cultural heritage. The results showed that these games contain various mathematical concepts, such as surface area, volume, comparison, congruence, chance, as well as the relationship between distance, speed, and time. These concepts are naturally embedded in the mechanics of the game, making it a potential medium for teaching mathematics through a culture-based approach. In addition, the game reflects Bugis cultural values such as togetherness, creativity and preservation of traditions. Togetherness is reflected in the close social interaction during the game, while creativity is seen in the utilization of coconut shells as game tools. The game also serves as a means to introduce and preserve cultural heritage to the younger generation, especially amidst the challenges of modernization.

To ensure the sustainability of *maggale* and *majjekka* games, a preservation strategy is needed that involves integration into formal education, cultural events, and utilization of digital technology for documentation and promotion. Support from the community, educational institutions and the government is essential to maintain the relevance of these games for future generations. Future research can explore the application of the game in the education curriculum, assess its impact on children's cognitive and social skills, and develop digital platforms to introduce the game to the younger generation while maintaining the essence of local culture.

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e-ISSN 2746-5594
p-ISSN 2746-5608

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