



The Role of Ethnomathematics in Preserving Traditional Indonesian Games: A Systematic Literature Review

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Abstract. Traditional Indonesian games play a significant role in preserving local culture while also serving as an effective medium for learning. This study aims to identify ethnomathematical elements in traditional Indonesian games and analyze their contribution to cultural preservation. Using a Systematic Literature Review (SLR) approach and the PRISMA protocol, the study examines seven relevant articles. The findings reveal that traditional games such as Congklak, Engklek, and Endog-Endogan contain various mathematical concepts, including geometry, arithmetic, logic, and probability. Furthermore, ethnomathematics contributes to character education, enhances cultural awareness, and provides contextual learning. However, the implementation of this approach faces challenges, such as a lack of teacher understanding and limited teaching resources. This study emphasizes the importance of integrating ethnomathematics into education to preserve traditional games as part of Indonesia's cultural heritage.

Keywords: Ethnomathematics, Traditional Games, Cultural Preservation, Mathematics Learning, Indonesia.

1 INTRODUCTION

Traditional games in Indonesia hold a significant role in the social and cultural life of its people [1]. These games are not only a source of entertainment but also serve as a medium for education [2], reinforcement of social values [3], and preservation of local wisdom. Games such as Congklak, Bola Bekel, and Lompat Tali embody cultural values that reflect the identity of local communities. However, with the advancement of technology and the growing popularity of digital games, children's engagement with traditional games has been steadily declining [3]. Research by Lintangkawuryan and Adiati [4] indicates that although approximately 70% of children in Indonesia are still involved in traditional games, this number decreases annually. This decline signals a threat to the sustainability of traditional games as part of Indonesia's cultural heritage.

On the other hand, traditional games are not merely recreational activities but also contain educational elements, including mathematical concepts that are naturally integrated into cultural practices. Ethnomathematics, as a field that connects culture and mathematics, offers a unique perspective on how specific communities utilize mathe-

mathematical concepts in their daily lives [5]. According to D'Ambrosio [6], ethnomathematics encompasses the practices, processes, and products of mathematics that develop within specific cultural contexts. In Indonesia, ethnomathematics can be found in various aspects of life, including traditional games. For instance, the game Congklak involves counting seeds, which reflects concepts of addition and subtraction, while Bola Bekel teaches strategy and intuitive calculations.

The relationship between ethnomathematics and traditional games is deeply intertwined, as traditional games often reflect mathematical principles used within specific cultural contexts. Research by Hidayati [7] shows that traditional games not only train mathematical skills but also strengthen social interactions among players. Thus, traditional games can serve as an effective medium for teaching mathematical values while preserving local culture. However, despite this potential, systematic research on the role of ethnomathematics in preserving traditional games remains limited.

Although some studies have discussed mathematical elements in traditional games [8], most of these studies are descriptive and focus on analyzing specific games. There is a lack of comprehensive research examining how ethnomathematics can contribute to the preservation of traditional games as part of cultural heritage. Furthermore, previous research approaches tend to be fragmented, failing to provide a holistic view of the relationship between ethnomathematics, traditional games, and cultural preservation. This highlights a research gap in understanding the strategic role of ethnomathematics as an approach to preserving traditional games amidst the challenges of modernization and globalization.

The urgency of this research lies in the need to preserve traditional games as part of Indonesia's cultural identity, which is increasingly threatened by technological advancements and lifestyle changes. Traditional games not only function as entertainment but also as educational tools that teach social, cultural, and mathematical values to younger generations. By understanding the ethnomathematical elements in traditional games, we can develop more effective strategies to preserve these games through both formal and informal education. Additionally, this research is relevant in a global context, where the preservation of local culture is a critical issue in the face of cultural homogenization caused by globalization.

This study employs a Systematic Literature Review (SLR) approach to identify, analyze, and synthesize previous findings related to the role of ethnomathematics in traditional games. Through this approach, the research aims to make a significant contribution to addressing the research gap while offering new insights into how ethnomathematics can be used as a tool to preserve local culture.

The objectives of this research are to identify the ethnomathematical elements embedded in traditional Indonesian games and to analyze how these elements contribute to the preservation of traditional games as part of the nation's cultural heritage. By understanding the relationship between mathematical concepts and the cultural context reflected in traditional games, this study aims to provide deeper insights into how traditional games function not only as entertainment but also as educational media that integrate cultural and mathematical values. Furthermore, this research seeks to explore the potential of ethnomathematics as a strategic approach to preserving traditional games amidst the challenges of modernization and globalization. Thus, this study is

expected to make a significant contribution to the efforts of preserving local culture while enriching the literature on ethnomathematics in the context of traditional games.

1.1 Research Question

1. What are the mathematical aspects found in traditional games?
2. How can ethnomathematics contribute to the preservation of traditional games?

2 METHODOLOGY

This study employs a SLR approach aimed at identifying, evaluating, and summarizing relevant research findings [9] on the role of ethnomathematics in preserving traditional Indonesian games. SLR was chosen due to its systematic and structured methodology, which allows researchers to obtain a comprehensive overview of the studied topic [10]. According to Moher et al. [11], SLR helps reduce bias and enhances the reliability of research findings by following established steps.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) protocol was applied in this study to ensure that the process of selecting and analyzing literature was conducted transparently and accurately. PRISMA provides clear guidelines on the steps to follow in an SLR, from study identification and selection to data synthesis [12]. By adhering to this protocol, the study aims to minimize bias and ensure that the results obtained are accountable [13]. The process of article identification using the PRISMA protocol is illustrated in Figure 1.

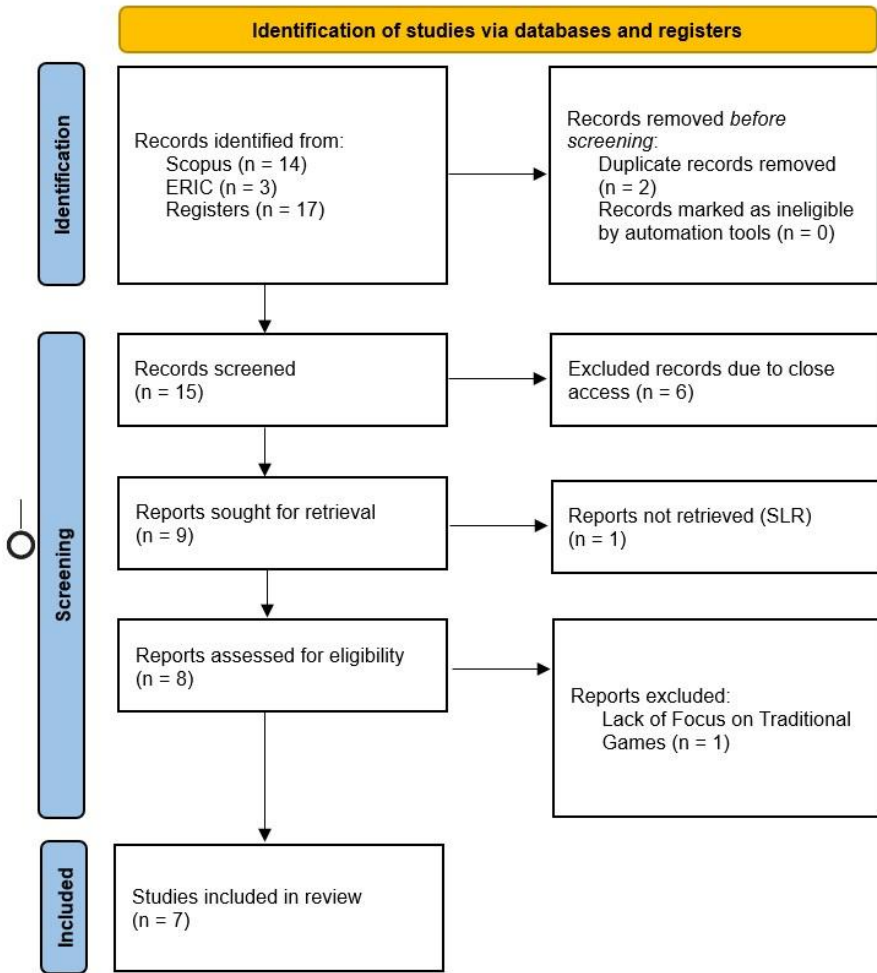


Figure 1. PRISMA Flow Diagram

2.1 Inclusion and Exclusion Criteria

The inclusion criteria for this study encompass research that discusses ethnomathematics and traditional Indonesian games, published between 2021 and 2025. Studies written in either Indonesian or English were included to broaden the scope of the literature. Additionally, only articles with clear methodologies and relevance to the research topic were considered for further analysis. The exclusion criteria, on the other hand, include literature that is not directly related to ethnomathematics or traditional games, as well as publications such as articles that are not available in full-text format.

The literature selection process was conducted in several stages. First, the researchers performed a search in relevant databases using specific keywords. Then, the identified articles were filtered based on the inclusion and exclusion criteria. Subsequently, an analysis was conducted by identifying the main themes in the selected literature and evaluating the methodologies and findings of each study. This analysis aimed to identify patterns and relationships between ethnomathematics and traditional games in Indonesia.

2.2 Data Sources

The databases used in this study were ERIC and Scopus, which are among the primary sources for academic research worldwide. ERIC and Scopus provide access to various journals, articles, and scientific publications relevant to the research topic. By using ERIC and Scopus, the researchers were able to find literature related to ethnomathematics and traditional games, as well as obtain up-to-date information on studies conducted in this field. Although ERIC does not provide quality indicators such as journal accreditation, the researchers assessed the credibility of sources based on journal reputation, citation counts, and the relevance of articles to the research topic.

In the literature search process, the researchers used specific keywords and search terms. Some of the keywords used included “Ethnomathematics” AND “Traditional Games.” This combination of keywords aimed to broaden the search and ensure that the identified literature covered various aspects related to ethnomathematics and traditional games. Additionally, the researchers conducted searches using English search terms to obtain relevant international literature.

3 RESULTS AND DISCUSSION

To provide a comprehensive understanding of the studies analyzed in this research, a list of reviewed articles is presented in Table 1. This presentation aims to provide a clear overview of the literature sources used, thereby supporting the findings related to the role of ethnomathematics in preserving traditional Indonesian games through a systematic literature review.

Table 1. List of Reviewed Articles

ID Paper	Title	Author	Year	Country
Paper 1	Implementation of a playful microproject based on traditional games for working on mathematical and scientific content	Fernández-Oliveras, et al.	2021	Spain
Paper 2	Ethnomathematics: Mathematical concept in the local game of tong tong galitong ji for high school	Turmudi, et al.	2021	IND
Paper 3	Ethnomathematics in mathematics, social and physical education	Supriadi, et al.	2019	IND

Paper 4	Games as STEAM learning enhancers. Application of traditional Jamaican games in Early Childhood and Primary Intercultural Education	Espigares-Gámez, et al.	2020	Spain
Paper 5	Ethnomathematics: Design mathematics learning at secondary schools by using the traditional game of Melayu Riau	Roza, et al.	2020	IND
Paper 6	Elementary School Students Reflection: Didactical Design Analysis on Integer and Fraction Operations on Mathematical Concepts with Sundanese Ethnomathematics Learning	Supriadi	2022	IND
Paper 7	Teachers' Perception toward the Use of Ethnomathematics Approach in Teaching Math	Mania & Alam	2021	IND

Based on Table 1, seven articles were reviewed, with the majority of the studies originating from Indonesia (IND). Of the seven articles, five were conducted in Indonesia, while the other two came from Spain. The dominance of articles from Indonesia can be attributed to the country's rich cultural heritage and traditional games, which serve as a primary source for ethnomathematical studies [9]. Traditional games in Indonesia, such as Tong Tong Galitong Ji and Riau Malay games, often contain mathematical concepts that can be integrated into learning. Additionally, the focus on preserving local culture through education is one of Indonesia's main priorities, which has encouraged more research in this field.

Another interesting aspect is the variation in research focus, such as the application of ethnomathematics in mathematics education, didactic design, and teachers' perceptions of this approach. Studies from other countries, such as Spain, place greater emphasis on integrating traditional games into interdisciplinary learning, such as STEAM (Science, Technology, Engineering, Arts, and Mathematics). This highlights that while the ethnomathematical approach is global in nature, its focus and context are heavily influenced by the local culture of each country.

3.1 Mathematical Aspects in Traditional Games

Traditional games not only serve as a medium of entertainment but also hold great potential as effective learning tools. In the context of ethnomathematics, traditional games can be used to teach various mathematical concepts in a contextual, enjoyable, and culturally grounded manner. This section aims to identify the mathematical aspects embedded in traditional Indonesian games and similar games from other cultures, as well as how these games can be utilized to support mathematics learning. Below are the key findings from the seven articles analyzed in this systematic literature review.

Table 2. List of key findings

Game name	Mathematical aspects
The games "The Dog and the Goats", "The Towers of the Alhambra", and "Mijnlieff"	1. Geometry Aspects: Introduction to flat shapes (squares, rectangles) and three-dimensional objects. 2. Counting and Patterns: Counting the number of game elements, recognizing repeating patterns, and measuring length and area. 3. Logic and Strategy: Logical reasoning, strategy design, and evaluation of game outcomes. Game Specifics: 4. The Towers of the Alhambra: Spatial ordering of elements, recognition of length and volume, and observation of geometric patterns. 5. Mijnlieff: Symbol recognition, calculation, and logic-based strategy development.
Tong Tong Galitong Ji (TTGJ) Game	6. Modulo Arithmetic: In the second to fourth stages, the concept of modulo arithmetic of 6 and 3 is discovered to determine player elimination. 7. Basic Mathematical Operations: Addition, subtraction, and multiplication at the fifth stage. 8. Arithmetic Sequence: Used to determine the amount of punishment. 9. Probability: The probability is calculated based on independent cases when two players show their fingers simultaneously.
Engklekmatika Game	10. This game is a modification of the traditional game Engklek which integrates mathematical concepts. 11. Unit Length: Students understand the concept of unit length through the activity of jumping from one box to another. 12. Mathematical Modeling: Students build mathematical models relevant to the concepts being studied. 13. Mathematical Communication: Games train students to share ideas and express opinions mathematically. 14. Mathematics and Cultural Connection: This game integrates Sundanese culture, making learning more contextual and relevant.

Traditional Jamaican Games

15. This game is a modification of the traditional game Engklek which integrates mathematical concepts.
16. Unit Length: Students understand the concept of unit length through the activity of jumping from one box to another.
17. Mathematical Modeling: Students build mathematical models relevant to the concepts being studied.
18. Mathematical Communication: Games train students to share ideas and express opinions mathematically.
19. Mathematics and Cultural Connection: This game integrates Sundanese culture, making learning more contextual and relevant.

Riau Malay Traditional Games (Ligu, Rimau, and Guli)

20. Sets: The concepts of subsets, universal sets, and binary operations on sets.
 21. Geometry: Relationship between angles, area and perimeter of flat shapes, and geometric transformations (reflection, translation, rotation, dilation).
 22. Theoretical Probability: Analysis of the outcome of suits and the position of marbles in a game.
- Game Specifics:**
23. League: Comparison of two quantities and congruence of plane shapes.
 24. Rimau: Proof of the Pythagorean theorem through right triangles on a game board.
 25. Guli: Elements of a circle (radius, diameter, central angle) and tangents to a circle.

Endog-Endogan Game

26. A traditional Sundanese game that teaches mathematical concepts through concrete modeling using eggs as a representation of numbers.
27. Integer Operations: Addition and subtraction of integers.
28. Fraction Operations: Addition and subtraction of fractions with different denominators.
29. Mathematical Modeling: Visualizing abstract concepts such as integers and fractions through real objects.
30. Symbol Understanding: Helping students distinguish the negative symbol from the subtraction operation.

Hopscotch Game

31. Geometry: Introduction to shapes such as rectangles and semicircles.
32. Symmetry: Reflection or symmetry in the playing pattern.
33. Counting: Counting the sequence of squares passed during the game.
34. Logic and Probability: Following the rules of the game and introducing the chances of success.

Traditional games have long been an integral part of community life across the world. Beyond serving as a form of entertainment, these games also carry deep cultural, social, and educational values [14]. One particularly interesting aspect to explore is how traditional games can be used as a medium for teaching mathematics [15]. Based on the findings of this SLR, it was discovered that traditional games encompass various mathematical aspects, such as geometry, arithmetic, logic, probability, and even mathematical modeling. These findings highlight the significant potential of traditional games to be integrated into mathematics education, particularly within the context of ethnomathematics.

Traditional games often involve activities that indirectly teach mathematical concepts [16]. For instance, geometric aspects can be found in games like *congklak* or *dakon*, which teach patterns, shapes, and spatial awareness through the placement of seeds into the game's holes [17]. Games like kite flying also involve an understanding of symmetry, angles, and geometric shapes [18]. Additionally, arithmetic aspects emerge in games that involve counting, such as *congklak* [19], where players unconsciously learn to count and manage the number of seeds [20]. Logical aspects can be found in strategy games like Javanese chess, which sharpen logical thinking skills through planning moves and predicting opponents' strategies [21]. Games involving elements of chance, such as traditional dice games, teach concepts of probability [22], where players learn to understand odds and risks. Some traditional games can even be used to teach mathematical modeling, where students analyze game situations and translate them into mathematical models [23].

In the context of ethnomathematics, traditional games offer a culturally relevant approach to learning. Ethnomathematics itself is an approach that connects mathematical concepts with local culture [10], making learning more meaningful and contextual. By using traditional games, students can learn mathematics in a familiar and enjoyable environment. For example, *congklak* not only teaches arithmetic and strategy but also introduces students to cultural values such as cooperation, patience, and sportsmanship. Thus, learning mathematics through traditional games not only enhances students' understanding of mathematical concepts but also helps preserve local cultural heritage [24].

The use of traditional games in mathematics education offers various benefits. These games can increase students' motivation to learn by making lessons more engaging and enjoyable [25]. Additionally, traditional games help students connect abstract concepts

with concrete experiences, making them easier to understand [26]. They also train critical and creative thinking skills, especially in games that involve strategy and logic [27]. Furthermore, incorporating traditional games into education contributes to the preservation of local culture [28], allowing students to not only learn mathematics but also recognize and appreciate their cultural heritage [29].

However, despite the significant potential of traditional games in mathematics education, several challenges need to be addressed. One challenge is the lack of documentation on traditional games, making it difficult to adapt them into the curriculum [30]. Additionally, teachers may face time and resource constraints when integrating traditional games into their lessons [21]. Nevertheless, these challenges also present opportunities for further research and the development of teaching materials based on traditional games. Through collaboration between educators, researchers, and local communities, traditional games can be effectively integrated into mathematics education.

Overall, traditional games are a rich resource for mathematics education. By integrating traditional games into learning, students can study mathematics in a culturally relevant, enjoyable, and meaningful context [31]. This approach not only enhances students' understanding of mathematical concepts but also preserves local cultural heritage. Therefore, it is essential for educators and researchers to continue exploring the potential of traditional games in mathematics education, particularly within the framework of ethnomathematics. In doing so, we can create more inclusive, relevant, and sustainable learning experiences.

3.2 The Contribution of Ethnomathematics to the Preservation of Traditional Games

Ethnomathematics is an approach to mathematics education that integrates mathematical concepts with local culture, including traditional games. This approach not only helps students understand mathematics in a contextual manner but also contributes to the preservation of local culture. Based on the analysis of the seven articles, ethnomathematics plays a significant role in preserving traditional games through various means.

First, ethnomathematics enables traditional games to be used as a medium for teaching mathematics. For example, the traditional game Endog-Endogan from Sundanese culture is used to teach operations with integers and fractions. In Supriadi's study (paper 6), it was noted that this game helps students grasp abstract concepts, such as subtraction of integers, in a more concrete and enjoyable way. *"Traditional games like Endog-Endogan make it easier for students to understand abstract concepts, such as the addition of negative and positive numbers, as they model these operations through the game"* (paper 6). Additionally, this game encourages students to think creatively and connect mathematical concepts with real-life experiences.

Second, traditional games like Engklek are also used to teach geometric concepts, such as symmetry, reflection, and mathematical logic. In the study by Mania and Alam (paper 7), it was highlighted that Engklek contains mathematical elements that help students understand flat shapes and the concept of reflection. *"Engklek contains mathematical elements such as flat shapes, reflection, and mathematical logic. By using this game, students not only learn mathematics but also become familiar with their local*

culture" (paper 7). This demonstrates that traditional games can be an effective tool for teaching complex mathematical concepts in a culturally relevant way.

Third, ethnomathematics also contributes to character education. Traditional games like Guli not only teach probability concepts but also instill values such as honesty, discipline, and creativity. In Roza's (paper 5) study, it was noted that traditional games can be used to develop students' character through culturally-based mathematics learning. *"Traditional games like Guli not only teach mathematical concepts but also instill character values such as honesty, discipline, and creativity"* (paper 5).

Fourth, ethnomathematics helps raise students' cultural awareness. By integrating traditional games into mathematics learning, students not only learn mathematics but also become familiar with and appreciate their local culture. This aligns with D'Ambrosio's [32] perspective, which states that ethnomathematics aims to connect students' mathematical knowledge with their culture, enabling them to understand how their culture relates to mathematical concepts.

However, the implementation of ethnomathematics in education is not without challenges. Some teachers report difficulties in integrating this approach due to a lack of understanding of ethnomathematics-based teaching methods and limited teaching resources. Mania and Alam (paper 7) noted that *"some teachers find it challenging to integrate ethnomathematics due to a lack of understanding of teaching methods and relevant materials."* Therefore, training and support for teachers are essential to address these challenges.

Overall, ethnomathematics makes a significant contribution to the preservation of traditional games by integrating them into mathematics education. This approach not only makes mathematics learning more contextual and relevant but also helps preserve local culture and instill character values in students. Thus, ethnomathematics can serve as a bridge between formal education and the preservation of traditional culture.

4 CONCLUSION

This study highlights the importance of traditional Indonesian games as an effective learning medium and a tool for preserving local culture. Through the ethnomathematics approach, traditional games not only teach mathematical concepts such as geometry, arithmetic, logic, and probability but also instill character values and enhance students' cultural awareness. Games like *Congklak*, *Engklek*, and *Endog-Endogan* demonstrate significant potential to be integrated into culturally relevant mathematics education. However, the implementation of ethnomathematics in learning faces challenges, including teachers' lack of understanding of this method and limited teaching resources. Therefore, training and support for educators are essential to overcome these obstacles.

Overall, this study affirms that ethnomathematics can serve as a strategic approach to preserving traditional games amidst the challenges of modernization and globalization. By integrating traditional games into formal education, we not only preserve local cultural heritage but also create more inclusive, relevant, and meaningful learning experiences.

4.1 Research Limitations

This study has several limitations that should be noted. First, although the SLR approach was used to provide a comprehensive overview, the number of articles analyzed was relatively limited, with only seven articles. This may affect the generalizability of the findings, especially considering the vast diversity of traditional games in Indonesia. Second, most of the analyzed articles focused on specific traditional games, leaving many other variations of traditional games from different regions in Indonesia unaddressed. Third, this study relied heavily on secondary data from available literature, without including direct empirical data from the practice of teaching or preserving traditional games in the field.

Additionally, another limitation lies in the lack of in-depth exploration of the implementation of ethnomathematics in the context of formal education. Practical challenges faced by teachers, such as insufficient training, limited teaching resources, and time constraints for integrating traditional games into the curriculum, were not discussed in detail. This study also did not explore how the ethnomathematics approach could be adapted for various educational levels, from primary to secondary education.

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