Journal of Honai Math, 7(1), 19-36, April 2024
https:/doi.org/10.30862/jhm.v7i1.512

Ethnomathematical investigation of traditional games for cultural preservation in the Indonesia-Timor Leste border region

Yohanis Ndapa Deda*, Hermina Disnawati

Universitas Timor, Nusa Tenggara Timur, Indonesia
* Correspondence: yndapadeda@unimor.ac.id

Received: 12 January 2024 | Revised: 17 April 2024 | Accepted: 24 April 2024 | Published: 28 April 2024

Abstract

Traditional games offer children numerous benefits, including health, character development, and educational resources. However, these games have yet to be explored as learning tools for students with dyscalculia, particularly in border areas. This research aims to investigate the mathematical concepts embedded in traditional games as part of the local culture in the Indonesia-Timor Leste Border Area (ITLBA) community. Employing an exploratory approach with an ethnographic methodology, the study utilized documentation, observation, and interviews involving 13 children aged 7-14 years and five informants from the border area. Findings revealed mathematical concepts, including geometry and numerical concepts, within traditional games such as *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak*. Moreover, these games instilled character values such as patriotism and sportsmanship. Children in the ITLBA region benefited from traditional games through social interaction, fostering kinship, cooperation, responsibility, and enhancing psychomotor skills. Ethnomathematics research on traditional games at ITLBA suggests utilizing these games as a platform for mathematics education, especially for students with disabilities. Leveraging classic games can help bridge the gap for students with disabilities, facilitating their numerical skills development within the educational context.

Keywords: Ethnomathematics study, ITLBA, local culture, traditional games

Introduction

The geographical locations of the four districts—TTU, Belu, TTS, and Malaka—in ITLBA place them on the frontier with Timor Leste, at the outermost and least developed areas relative to Jakarta. This positioning can threaten the uniqueness of local culture, similar to what Malaysia has done with batik, shadow puppets, and the Reog Dance (Nita, 2021). This issue is particularly concerning for students in the Indonesia-Timor Leste Border Area (ITLBA),

especially those with disabilities, due to the sociocultural connections inherent to their local environments. A proposed solution to mitigate cultural appropriation is to explore traditional games as a form of cultural expression and a resource for educational purposes, specifically in learning mathematics. The traditional games discussed in this context include *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak*.

Globalization has led to the loss of local culture, which necessitates conservation efforts (Suprapto et al., 2021). Integrating local culture into educational programs can be an effective strategy to both prevent this cultural erosion and facilitate more accessible learning for students with disabilities, especially in mathematics. Traditional games can be an excellent entry point for learning mathematics, promoting independent learning and numerical literacy. In the past, children frequently played these traditional games, which were particularly popular among those aged five to ten years (Suryawan, 2020). However, these games have declined in popularity, primarily due to the rise of technology-dependent video and internet games. The spread of smartphone-based games has led to the gradual disappearance of traditional games, contributing to the loss of local wisdom and cultural practices.

This research aims to examine mathematical concepts embedded in traditional games, benefiting ITLBA students and contributing to the preservation of local culture. Classic games are part of children's heritage and cultural practices that should be maintained (Supriyono, 2018; Yulita, 2017). By focusing on traditional games, this study also endeavors to revive these cultural practices, ensuring they continue to be part of future generations' learning and socialization process.

Playing marble offers a range of moral, social, emotional, and physical benefits (Khosasi et al., 2018). Morally, the game promotes honesty among children, while its socio-emotional benefits include boosting self-esteem, teaching social skills, and fostering emotional control to focus on goals. Additionally, marbles support children's fine motor skills development through physical activities. Traditional games like marbles are filled with exercises that inspire creative thinking in children.

These games also contain mathematical concepts that might be new to kids. Mathematical elements in traditional games indicate that mathematics is intertwined with human societies and everyday activities. Mathematics plays a crucial role in human progress and is especially important for students, as it is a core subject in education. Daily life encompasses many mathematical principles, so mathematics education is vital (Friantini & Winata, 2019).

The deep connection between mathematics and daily life is known as ethnomathematics, a term coined by D'Ambrosio (1985). Ethnomathematics aims to identify various ways mathematical activities are conducted, considering the different knowledge systems that exist across cultures. This approach to mathematics covers mathematical concepts and acknowledges their cultural significance. Employing ethnomathematics in education can make learning more engaging and culturally relevant for students (Rosa & Orey, 2021; Scott, 2022).

Exploring ethnomathematics is crucial because it allows educators to incorporate mathematical elements into teaching, using traditional games to preserve local culture. In the past, children were deeply engaged with traditional games, but with the rise of sophisticated

technology-based games, there's been a noticeable shift away from these cultural practices. This change has diminished children's understanding of the mathematical concepts inherent in traditional games.

To address this, it's essential to reintroduce and explore traditional games as a way to preserve local culture, especially in the Indonesia-Timor Leste Border Area. This approach fosters cultural preservation and serves as an innovative method to teach mathematical concepts through culturally relevant activities. By reconnecting with traditional games, educators can offer a more engaging learning experience while also reviving nearly extinct cultural practices.

Methods

The research employed an exploratory approach with an ethnographic methodology to gain detailed descriptions and analyses of cultural practices through fieldwork (Sugiyono, 2017; Abdullah, 2016). This study was conducted from June to July 2023 in ITLBA, focusing on Mnelalete Village (TTS), Upfaon Village (TTU), and West Manleten Village (Belu). The research subjects included five adults aged 40 years and nineteen children who played traditional games: eight in *Siki Doka,* four in *Kelereng,* and two each in *Congklak* and *Siki Doka*. The total number of participants was nineteen.

The research preparation stage involved creating interview guidelines and observation sheets. During the implementation stage, the researcher visited four districts to observe traditional game activities as part of the local culture in ITLBA (TTU, TTS, and Belu). The exploratory ethnographic approach allowed the researchers to gather in-depth insights into how traditional games are practiced and their significance in preserving local culture.

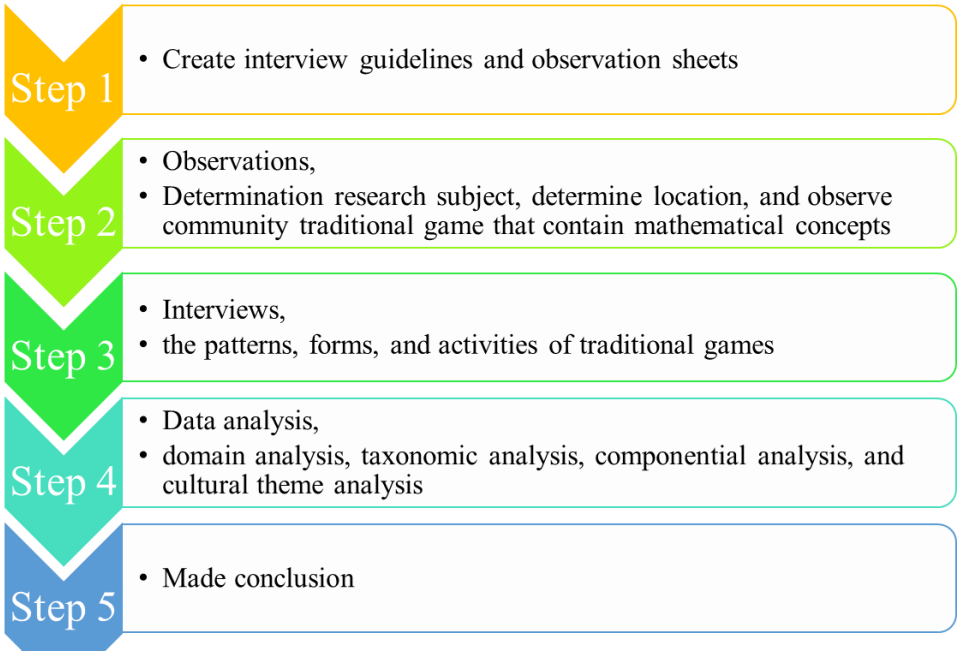


Figure 1. Research method

As outlined in Figure 1, the research procedure consists of five stages. Stage 1 involves creating interview guidelines and observation sheets to facilitate data collection. Stage 2 focuses on observation, which includes determining research subjects, selecting locations, and observing traditional community games with mathematical concepts. Stage 3 is dedicated to interviews, where researchers explore the patterns, forms, and activities of traditional games. Stage 4 encompasses data analysis, which includes domain analysis, taxonomic analysis, componential analysis, and cultural theme analysis. Stage 5 involves drawing conclusions based on the data collected.

Additionally, the selection of research subjects included children aged 7-14 years and informants aged over 40 (as detailed in Table 1). This range of ages allows for a broader understanding of traditional games and their cultural significance, offering insights from both the younger generation actively engaged in these games and the older generation with a more comprehensive historical perspective.

Table 1. Informants Characteristics

No	Informants	Characteristics
1	16 children aged 7-14 years old	frequency of playing once a week after school
2	5 community leaders aged over 40	experienced in playing traditional games

In the observation stage, the research focused on traditional community games that could potentially include mathematical concepts, supporting students with disabilities at ITLBA. Researchers conducted individual and group interviews with each research subject to gather detailed information. The aim was to comprehensively understand the patterns, forms, and activities within these traditional games, guided by interview protocols.

Following the observation and interview stages, the data analysis phase, as illustrated in Figure 1, involved several steps: domain analysis, taxonomic analysis, componential analysis, and cultural theme analysis. Researchers used data source triangulation to ensure data reliability by comparing findings from interviews, observations, and supporting documentation.

The final stage was concluding the research purpose and synthesizing the data from all stages (Amsikan & Deda, 2023; Deda & Amsikan, 2019; Dominikus, 2021). This comprehensive approach provided a thorough understanding of traditional games and their potential to support educational goals while preserving local culture.

Results and Discussion

Communities in the Indonesia-Timor Leste Border Area (ITLBA) have a rich tradition of games often played by children, forming a significant part of their cultural heritage since ancient times. Examples of these traditional games include *Galah Asin*, *Pot Poto* (bamboo gun), Jumping Rope, *Kelereng* (marbles), *Siki Doka*, *Congklak*, *Pio* (also known as *Gasing*), *Patok Lele*, *Jetu*, Rubber games, *Kasti* ball, Hide and Seek, and kite flying (Supriyono, 2018). Observations

indicate that these games are still played by children in this border region, which is part of the archipelago. Thus, these traditional games are integral to the archipelago's culture. This research focuses specifically on the traditional games of *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak*, exploring their roles in cultural preservation and educational development.

Observation of *Galah Asin* Traditional Game

The traditional game *Galah Asin*, also known as *Gobak Sodor*, is typically played in a large yard or field marked with a checkered rectangle. This classic game involves two teams, each consisting of three to five players. The play area is divided into four sections, with boundaries often marked by chalk or wood and sometimes sprinkled with kitchen ashes for visibility (refer to Figure 2). Historically, these divisions were made with wood, but modern safety standards recommend fewer rigid materials.

Based on observation results, the rules of *Galah Asin* require two teams: Team A (green highlights) and Team B (orange highlights). Before starting, the children create the game arena and then divide into teams, each with four members. They decide which team will guard and which will attack using a simple game like *Hompimpa* (rock, paper, and scissors). Team A was designated as the attacking team in this observation, starting from the initial line. Here's how the game unfolds:

1. Team setup: The guarding team splits into two groups, with some players guarding the vertical lines and others guarding the horizontal lines.
2. Starting point: The attacking team begins from the starting line.
3. Horizontal guards: Players guarding the horizontal lines aim to prevent the attacking team from crossing the designated boundaries towards the finish line.
4. Vertical guards: The player(s) guarding the vertical line typically have more freedom of movement, patrolling along the vertical boundaries in the middle of the field to intercept opponents attempting to break through.
5. Goal: The attacking team tries to avoid contact with the guards and reach the finish line.
6. Winning conditions: A team wins if all its members return safely to the starting line.
7. Losing conditions: If the guards touch any attacking team member, their team loses, resulting in a role reversal with the guarding team.

This structured approach to *Galah Asin* showcases the game's strategic and physical elements, with roles and rules designed to foster teamwork and coordination.

(a) (b)

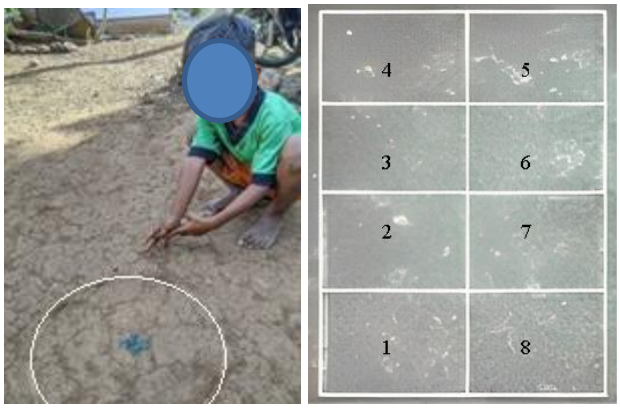
Figure 2. *Galah Asin* is a traditional game in Oekamusa District TTS (a) and the traditional game of *Kelereng* type of *Pot* (b)

Observation of the *Kelereng* Traditional Game

The traditional game of marbles is commonly played by children in border regions, with different variations like *Tor*, *Pot*, and *Apollo*. This study focused on the *Pot*-type marble game. Based on observation, the traditional game of *Pot*-type marbles involves the following stages:

1. Circle formation: A circle is drawn on the ground, which serves as the play area.
2. Starting positions: All players stand parallel, about one meter behind the circle's boundary, as shown in Figure 2b.
3. Throwing marbles: Players take turns throwing their marbles toward the marbles placed in the center of the circle.
4. Order of play: The player whose marble lands furthest from the circle gets to play first. Accuracy is vital, and players must focus on their aim to achieve the desired outcome.
5. Attacking phase: The player who successfully lands his marble inside the hole can attack opponents' marbles. If a player's marble is hit, it is considered "dead" and can no longer be played.
6. Constraints on attacking: Players who have not placed their marbles into the hole cannot attack or "kill" other marbles.
7. Risk of friendly fire: Players can accidentally shoot their teammates' marbles, adding an element of unpredictability.
8. Defensive strategies: Players might hide their marbles in obscure places, such as under rocks or between them, to avoid attacks.
9. Game conclusion: The game ends when all marbles are "dead," leaving only one marble remaining. The traditional shooting technique involves closing the thumb with the middle finger and then flicking it to strike the marbles accurately (refer to Figure 3a).

This structure for the *Pot*-type marble game illustrates the strategic and skillful aspects of playing marbles, with players needing to navigate between offensive and defensive tactics to win the game.



(a) (b)

Figure 3. One of the players rolls marbles into a circle **(**a**)** and the usual *Siki Doka* (b)

Observation of the *Siki Doka* Traditional Game

Siki Doka is a traditional children's game widely known in the Indonesia-Timor Leste border region. It has various names depending on the area. In Java, it's called *Engklek*; in North Sumatra, it's *Marsitekka*; in Betawi, it's *Dampu Bulan*; in Riau, it's *Setatak*; in Jambi, it's *Tejek-tejekan*; in South Sumatra and Minangkabau, it's *Cak Ingkling* or *Main Dore*; in Gorontalo, it's *Tengge-tengge*; in Banjarmasin, it's *Inting*; and in Makassar, it's *Denden*. At ITLBA, several versions of *Siki Doka* exist, such as *Siki Doka Biasa*, *Siki Doka Salib*, *Siki Doka Robot*, and *Siki Doka Silet*. Based on observations, the stages of the typical *Siki Doka* game (see Figure 3b) are as follows:

1. Determining order: The game starts with a *Hompimpa* (rock, paper, and scissors) to determine the playing order. The winner goes first.
2. Starting play: The first player throws an object called Era into the first square and then hops on one foot to move Era to the second square without touching the ground with the other foot. This continues until the eighth square.
3. Progressing play: The player throws Era into the second square and hops through the squares to move Era to the third square. The same pattern continues, with the player jumping on one foot and avoiding ground contact with the other foot.
4. Repetition: This process is repeated by tossing Era into subsequent squares until it reaches the eighth square.
5. Balancing challenge: Players shake Era using one leg without touching the ground with the other foot (see Figure 4a).
6. Jumping phase: After moving Era through the squares, the player jumps into the first box, shaking the leg carrying Era, and then jumps through the remaining boxes using the other foot until they pass the eighth box.
7. Catching phase: Upon exiting the eighth box, the player throws Era into the air and catches it with their hands.
8. Shaking with hands: This stage is similar to the leg-shaking phase, but now, hands are used to control era. The object is tossed up and caught using the back of the hand.

9. Hand-based movement: With Era on the back of the hand, the player proceeds through each box while lifting one leg, avoiding touching the ground with the other. Once past the eighth box, Era is thrown up and caught with the palm.
10. Blind navigation: Players are challenged to move through the boxes without looking at them, using one hand to balance on their head. If the player's step lands precisely within the box, the opposing team acknowledges with a "B" (for "correct"), but if not, the response is "S" (for "wrong").
11. Neck position: The hand-carrying Era rests on the neck, and the player repeats the movement from steps 8 to 10.
12. Chest position: The hand holding Era rests on the chest, and the same movements from steps 8 to 10 are repeated.
13. Abdomen position: The hand holding Era rests on the abdomen, following the same pattern from steps 8 to 10. When reaching the seventh box, the player returns to the start by standing on one leg, then moves Era to the palms. The player creates a "home" in the sixth box where they can stand with both feet, then jumps out of the eighth box.
14. Replaying with modifications: The game is then replayed from steps 1 to 13, but in the boxes that have become "homes," the players can use both feet. Additionally, Era cannot rest in the boxes designated as homes and must be moved around them. The game continues until all squares have houses, and the player with the most houses wins this classic *Siki Doka* game.

These stages demonstrate the skill, balance, and coordination required to play *Siki Doka*, reflecting this classic game's cultural significance and variations in different regions. These stages also illustrate the complexity and adaptability of the *Siki Doka* game, emphasizing physical coordination, balance, and a set of unique game mechanics that contribute to its enduring popularity among children in the Indonesia-Timor Leste border region.

(a) (b)

Figure 4. Shake Era's player used one of his legs **(**a**)** and the traditional *Congklak* game in the Manufui **(**b**)**

In the *Siki Doka* game, various mistakes can cause a player to lose their turn. These errors include stepping on or over a boundary line, placing a foot outside the designated play area, and using both feet to step on a box that isn't their "home." Mistakes involving the Era, the game piece, are also common; this can happen if it's thrown outside the play area, lands on a line, or is placed in the wrong box. Errors in movement include shifting the Era past the intended box, dropping it while it's being shaken with feet or hands, or failing to catch it properly when thrown. Additional missteps occur when a player tries to glance at their steps during critical stages or if they step into a box that belongs to another player. These mistakes require players to maintain focus and precision to succeed in the game.

Observation of *Congklak* Traditional Game

The *Congklak* game is known as *Fatuklala* in the Indonesia-Timor Leste border region. The term "*Fatuklala*" is derived from "*Fatu*," meaning stone, and "*Klala*," which refers to moving stones from one hole to another to maximize the number of rocks while depleting the opponent's area. The *Fatuklala* game board in this region has 12 holes divided into two sides, with each player having six holes. There is a larger central hole known as "*ana*," where players can take stones, and another hole at the top, called "*king*," which collects winning stones.

The game is played by two people facing each other (see Figure 4b). Each tiny hole is filled with 5 to 7 seeds, typically mustard seeds, shells, or small stones, while the two large holes at the ends are left empty. Players move the seeds or stones from one hole to another clockwise, with one seed placed in each hole until the rocks in hand run out. The game ends when one player has no more stones to move or when both players agree to stop. The winner is the player with the most stones at the end.

As part of the research design, unstructured interviews were conducted with five informants across three locations in ITLBA. Interview guidelines were used to guide the discussions. In Mnelalete Village, West Amanuban, and TTS, one community leader with the initials KM, a 43-year-old housewife, was interviewed on June 30, 2023. In Upfaon Village, South Biboki, TTU, and two community leaders were interviewed: FN, a 40-year-old housewife, and YA, a 54-year-old male farmer, on July 6, 2023. In West Manleten Village, East Tasifeto Sub-district, Belu District, two male community leaders, XT, a 45-year-old village official, and BKU, a 50-year-old farmer, were interviewed. The interviews focused on the shape of the arena and activities during *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak* (*Fatuklala*). Following observations and interviews, the researcher conducted data analysis in various stages to synthesize the information gathered.

Domain Analysis

The researchers identified ethnomathematics domains in the traditional games of *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak* (*Fatuklala*). These domains include the shape of the game arena and the activities involved during gameplay. This finding demonstrates how traditional

games incorporate mathematical concepts and patterns in their design and execution, providing a valuable intersection between culture and mathematics.

Taxonomic Analysis

The following data analysis stage is taxonomic analysis, where the researcher examines the domain identified as the research focus (Amsikan & Deda, 2023; Uskono et al., 2023). Based on the study's findings, which involved observing and analyzing the design and playing activities in traditional games like *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak* (*Fatuklala*), two key elements were identified:

1. The shape of the game arena: This includes the physical layout and the tools used in games like *Galah Asin*, *Kelereng*, *Siki Doka*, and *Congklak*. The design and structure of these arenas are integral to how the games are played.
2. Game activities, rules, and techniques: This encompasses the specific activities, gameplay rules, and techniques unique to each game. While similar in some respects, the games have distinct rules and approaches that reflect their cultural context.

These two aspects form the core focus areas in the taxonomic analysis, allowing for a deeper understanding of how these traditional games are structured and played.

Component Analysis

In the compensatory analysis stage, the researcher delves into detailed data from the games *Galah Asin*, *Klereng*, *Siki Doka*, and *Congklak* to identify specific mathematical concepts within these traditional games. This approach thoroughly examines the components related to the design and gameplay activities, as outlined in Table 2. By scrutinizing these components, the researcher aims to uncover underlying mathematical patterns, principles, or concepts that emerge from these traditional games' design and gameplay mechanics. The analysis provides insights into how these games can be used as educational tools, demonstrating the inherent relationship between cultural practices and mathematical ideas.

Table 2. Component Analysis

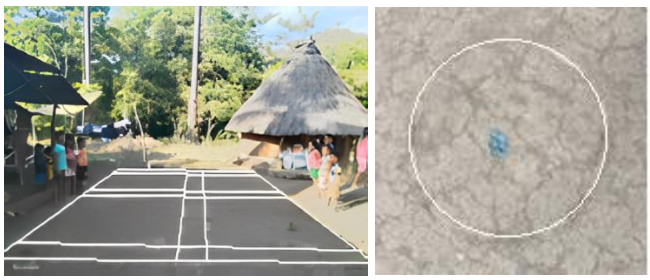
Traditional Games	Component Analysis	
	Shape and design arena	Game activity
Galah Asin	Little wood and lime or ashes to make line in the playing field The shape of *Galah Asin* in the playing arena	Body movement and position of the players
Kelereng	The tools used in the game *Kelereng* are marbles balls and holes. The form of the game *Kelereng* is a hole in the playing field	The hands movement position and feet when playing game *Kelereng*

Siki Doka	Era and little wood to make line in the playing field The type of *Siki Doka*	the body movement of the position of the hands and feet when playing the game *Siki Doka*
Congklak	The tools used in the game *Congklak* are pieces of wood to make a hole in the *Congklak* game arena. The form of the *Congklak* game	The body movement of the position of the hands when playing the game *Congklak*

Mathematical Concepts and Cultural Values in *Galah Asin* Traditional Game

Interviews with community leaders at ITLBA revealed that the length and width of the *Galah Asin* playing arena are generally determined by the size of the participant's steps. The typical dimensions are 7 feet long (approximately 5 meters) and 5 feet wide (around 4 meters), forming a rectangular shape. Several mathematical concepts were identified from exploring the traditional *Galah Asin* game. These include counting, symmetry, unity, and counting steps from one to seven, as agreed upon by both teams. Additionally, the arena's design, resembling a rectangle, demonstrates the concept of a flat-sided geometric space.

These findings align with earlier explorations in West Java's Tanah Laut area, where similar mathematical concepts were observed in traditional games (Jabar et al., 2022). Children in the border areas recognize these mathematical elements, such as counting steps and the rectangular structure of the playing field, showing that traditional games can embed valuable mathematical principles. Integrating the traditional *Galah Asin* game into mathematics education, particularly for students with disabilities at ITLBA, can be a fun and effective way to learn mathematical concepts (Amalia, 2019).



(a) (b)

Figure 5. *Galah Asin* traditional game arena (a) and the shape of a circle in the traditional game of Tor-type marbles (b)

Besides the mathematical concepts inherent in the *Galah Asin* game, this traditional game offers numerous additional benefits. Playing *Galah Asin* brings happiness, sharpens strategic

thinking, fosters responsibility and sportsmanship, nurtures a fighting spirit, and develops leadership skills. The game also positively impacts psychomotor skills, such as strength, balance, concentration, speed, flexibility, and endurance.

These benefits and values align with the teamwork skills that the classic *Galah Asin* game encourages (Nurmarawati et al., 2019). As players collaborate and compete, they develop physical capabilities and social skills that contribute to their overall personal growth. This blend of physical, strategic, and social elements makes *Galah Asin* a valuable traditional game with multiple benefits.

Mathematical Concepts in the *Kelereng* Traditional Game

The traditional *Tor*-type marble game embodies several mathematical concepts. Observations of these traditional marble games and interviews with community leaders at ITLBA revealed the presence of geometric ideas, including balls, circles, and straight lines, which are inherent in classic marble games. These findings align with the research conducted by Pratiwi, which also identified geometric concepts like circles, balls, triangles, and the idea of distance in marble games (Hendriawan & Faridah, 2022).

The mathematical concepts embedded in traditional marble games can be an engaging medium for teaching mathematics (Silfiana & Widyastuti, 2021), providing an enjoyable learning experience for students with disabilities at ITLBA. These classic games are expected to enhance the learning outcomes in mathematics, particularly for students with dyscalculia. Given that many students in ITLBA spend significant time playing and engaging in recreational activities, using traditional game-based media for teaching mathematics could facilitate a more effective and enjoyable learning process (Zulviansyach et al., 2023). Educators can create a more interactive and culturally relevant approach to mathematics learning by incorporating these traditional games into educational settings.

Mathematical Concepts in the *Siki Doka* Traditional Game

Observations of the usual *Siki Doka* traditional game activities and interviews with community leaders at ITLBA revealed several geometric concepts within the different types of *Siki Doka*. In the usual *Siki Doka* game, the geometric concepts included quadrilaterals, symmetry, and congruence in the playing field layout. For the *Siki Doka Silat* type, additional shapes like triangles and rectangles were observed, contributing to the game's structural design.

The *Siki Doka Robot* game variant demonstrated different geometric concepts, including circles, symmetrical designs, and rectangular patterns. Additionally, fractions were identified, where certain areas of the playing field were divided into smaller sections (refer to Figure 6 for details). These geometric concepts illustrate the diverse mathematical elements present in the various types of *Siki Doka* traditional games, reflecting their potential as engaging tools for teaching and exploring mathematical ideas in a cultural context.

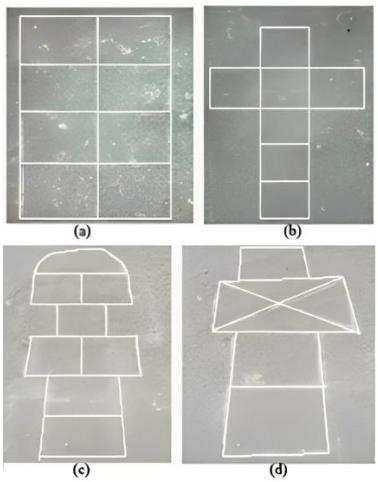


Figure 6. Four types of *Siki Doka* traditional game

In the *Siki Doka* game, fractions are derived from dividing the playing field into boxes, with each box representing a fraction of the total area. For example, if a player has built a house or gained control of one of the eight available boxes, such as box number 8, then the ownership can be represented as the expected fraction $\frac{1}{8}$. This fraction represents the proportion of the game arena controlled by that player. The comparison of these boxes by the two players at the end of the traditional *Siki Doka* game determines the winner, illustrating the application of fractions in a practical setting. This concept of fractions has been applied in elementary school mathematics learning (Edo & Samo, 2018). Additionally, learning through traditional games like Siki Doka can enhance motivation, improve mathematics learning outcomes (Yumiati et al., 2023), and foster greater interest in mathematics (Aras & Zahrawati, 2021).

Thus, the *Siki Doka* game can serve as a practical starting point for introducing the concept of fractions and for learning about geometric shapes like triangles and rectangles, especially for students with disabilities at ITLBA. Beyond mathematical concepts, playing *Siki Doka* brings joy and excitement, training balance and agility in children aged 5 to 10. It also provides a helpful alternative to gadgets, potentially reducing children's screen time (Sari et al., 2022). By engaging in *Siki Doka*, children in ITLBA can strengthen their social bonds and cultivate a sense of belonging and national pride (Zayyadi et al., 2018; Taskiyah & Widyastuti, 2021). Thus, traditional games play a significant role in educational and social development.

Mathematical Concepts in the *Congklak* Traditional Game

Observations of the traditional *Congklak* game activities and interviews with five community leaders at ITLBA revealed several mathematical concepts within the traditional *Congklak* (*Fatuklala*) game. These concepts include both geometry and numbers. The principles of numbers can be found in playing activities like *Congklak*, where players count, add, and divide the *fatu* (stones) in each hole based on the number of rocks collected. The concept of geometry is evident in the layout of the playing field, with the *Congklak* head shaped as a semicircle, the rectangular shapes on the playing surface, and the half-ball holes in the *Congklak* playing area.

The game also demonstrates the concept of reflection transformation, where the *Congklak* holes mirror each other, and arithmetic operations in the gameplay. Additionally, number patterns emerge from the playing strategies.

These mathematical concepts align with the findings from previous research by Taus et al. (2022). The traditional *Congklak* game can increase students' interest in mathematics (Kamid et al., 2021), promote cooperative character, and yield positive student responses towards mathematics (Kamid et al., 2021). By incorporating mathematical elements, educators can create engaging learning experiences that foster interest and improve skills in students (Kamid et al., 2022). Thus, traditional *Congklak* games offer a valuable medium for teaching and learning mathematics, demonstrating the intersection between cultural activities and educational concepts (Handayani & Iswantiningtyas, 2020).

Conclusion

The findings from the study indicate that traditional games like *Galah Asin*, Marbles, *Siki Doka*, and *Congklak*, as part of the local culture in the Indonesia-Timor Leste Border Area, contain various mathematical concepts. The traditional game of *Galah Asin* encompasses both geometry and numerical concepts. Numerical concepts are observed in counting activities, while geometric concepts are evident in the layout of the flat-sided playing arena.

For the traditional marble game, the identified mathematical concepts include geometric ideas such as the shape of the marbles, circular arenas, straight lines, and counting activities during gameplay. In the *Siki Doka* game, geometric concepts are represented by quadrilaterals, symmetry, and congruence in the playing field. Different types of *Siki Doka* games, like *Silat* and *Robot*, also demonstrate geometric concepts such as triangles, rectangular shapes, circular designs, and fractions. The traditional *Congklak* game (*Fatuklala*) features a variety of geometric concepts, including semicircles (in the *Congklak* head), rectangles, and half-balls found in the ground holes of the playing arena. It also introduces arithmetic operations through the counting, adding, and dividing of the *fatu* (stones) in each hole, along with patterns observed during gameplay. These insights suggest that traditional games like *Congklak* can be used to teach mathematical concepts engagingly.

In addition to the mathematical concepts, the character values associated with these traditional games include love for the motherland and sportsmanship. Other benefits for children playing these games at ITLBA include social interaction, strengthening kinship ties, promoting cooperation and responsibility, and enhancing psychomotor skills. Lastly, we recommend using these traditional games as a context for learning mathematics for elementary school students in border areas, especially those with disabilities. These classic games offer an inclusive platform that can help bridge the gap and improve numeracy skills for students with disabilities.

Acknowledgment

We would like to express our gratitude to the Directorate General of Higher Education, Research, and Technology (DRPTM Kemendikbudristek) for funding this research. This article is a mandatory deliverable from the first year of our multi-year regular fundamental research grant (PFR), covering the period from 2023 to 2025. The research is supported under contract number 174/E5/PG.02.00.PL/2023 and 115/UN60/LPPM/PP/2023. We appreciate the support and resources provided for this study.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

References

Abdullah, A. S. (2016). Ethnomathematics in perspective sundanese culture. *Journal on Mathematics Education*, 8(1), 1–16. http://dx.doi.org/10.22342/jme.8.1.3877.1-15

Amalia, N. (2019). Integrating learning through children game: 'Galah Asin', one play, several disciplines. *Humanities and Social Sciences Reviews* 7(3). https://doi.org/10.18510/hssr.2019.7360

Amsikan, S., & Deda, Y.N. (2023). Ethnomathematics exploration of traditional games of Kaneka and Mariam in Nangapanda, East Nusa Tenggara. *Journal of Honai Math,* 6(2), 88–98. https://doi.org/10.30862/jhm.v6i2.434

Aras, A., & Zahrawati, F. (2021). Fostering students' interest in mathematics learning with the utilization of ethnomathematics through Makkudendeng traditional game. *MaPan* 9(1), 27-39. https://doi.org/10.24252/mapan.2021v9n1a3

D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, 5(1), 44-48. Retrieved from https://www.jstor.org/stable/40247876

Deda, Y.N., & Amsikan, S. (2019). Geometry concept on the motifs of Woven Fabric in Kefamenanu Community. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, 4(1), 23-30. https://doi.org/10.23917/jramathedu.v4i1.6253

Dominikus, W. S. (2021). *Hubungan etnomatematika adonara dan matematika sekolah*. Malang: Media Nusa Creativery.

Edo, S. I., & Samo, D. D. (2018). Lintasan pembelajaran pecahan enggunakan matematika realistik konteks permainan tradisional Siki Doka. *Mosharafa: Jurnal Pendidikan Matematika*, 6(3), 311–22. https://doi.org/10.31980/mosharafa.v6i3.320

Friantini, R.N., & Winata, R. (2019). Analisis minat belajar pada pembelajaran matematika. *JPMI (Jurnal Pendidikan Matematika Indonesia)*, 4(1), 6-11. https://doi.org/10.26737/jpmi.v4i1.870

Handayani, A. D., & Iswantiningtyas, V. (2020). Javanese traditional games as a teaching and learning media to socialize and introduce mathematics since early Age. *Journal of Physics: Conference Series*, 1521(3). https://doi.org/10.1088/1742-6596/1521/3/032008

Hendriawan, P., & Faridah, S. (2022). Eksplorasi etnomatematika pada permainan tradisional

bekles. *Jurnal Tadris Matematika*, 5(2), 149–58. https://doi.org/10.21274/jtm.2022.5.2.149-158

Jabar, A., Gazali, R.Y., Ningrum, A.A., Atsnan, M.F., & Prahmana, R.C.I. (2022). Ethnomathematical exploration on traditional game Bahasinan in Gunung Makmur Village the regency of Tanah Laut. *Mathematics Teaching-Research Journal*, 14(5), 107–27. Retrieved from https://eric.ed.gov/?id=EJ1382677

Kamid, K., Rohati, R., Hobri, H., Triani, E., Rohana, S., & Pratama, W.A. (2022). Process skill and student's interest for mathematics learning: playing a traditional games. *International Journal of Instruction*, 15(3), 967–988. https://doi.org/10.29333/iji.2022.15352a

Kamid, K., Sofnidar, S., Septi, S. E., & Citra, Y. D. (2021). The contribution of the traditional game of Congklak to mathematics learning: How is the relationship and influence of interest, cooperative character and student responses. *Premiere Educandum: Jurnal Pendidikan Dasar Dan Pembelajaran*, 11(2), 280-295. http://doi.org/10.25273/pe.v11i2.9995

Kamid, K., Syaiful, S., Theis, R., Sufri, S., Septi, S.E., & Widodo, R.I. (2021). Traditional 'Congklak' games and cooperative character in mathematics larning. *Jurnal Ilmiah Sekolah Dasar*, 5(3), 443-451. http://doi.org/10.23887/jisd.v5i3.37740

Khosasi, L., Damajanti, M.N., & Muljosumarto, C. (2018). Perancangan media pengenalan permainan tradisional untuk mendukung tumbuh kembang anak usia 6-9 tahun. *Jurnal DKV Adiwarna*, 1(12), 1–8. Retrieved from https://publication.petra.ac.id/index.php/dkv/article/view/7193/652

Nita, D. (2021). *5 Budaya Indonesia yang pernah diklaim Malaysia, terbaru Wayang Kulit oleh Adidas*. Retrieved [5 January 2024] from https://www.kompas.tv/entertainment/232503/5-budaya-indonesia-yang-pernah-diklaim-malaysia-terbaru-wayang-kulit-oleh-adidas?page=all

Nurmarawati, D., Heryanto, D., & Syarifudin, T. (2019). Model cooperative script berbantuan permainan galah asin untuk meningkatkan keterampilan kerja sama siswa kelas IV SD. *JPGSD: Jurnal Pendidikan Guru Sekolah Dasar*, 4(1), 235-244. https://doi.org/10.17509/jpgsd.v4i1.20663

Rosa, M., & Orey, D. (2021). Ubiratan D'Ambrosio: Celebrating his life and legacy. *Journal of Humanistic Mathematics*, 11(2), 430-450. https://doi.org/10.5642/jhummath.202102.26

Sari, D. K., Dwipurra, P.H., Rizky, S.N., & Masrifah, L. D. (2022). Traditional games, use gadget: Pendampingan permainan tradisional dalam mengurangi penggunaan gadget pada anak pra sekolah di PAUD Cahaya Hati kota Kediri. *Journal of Community Engagement in Health*, 5(1), 51–63. https://doi.org/10.30994/jceh.v5i1.339

Scott, P. (2022). In memoriam Ubiratan D'Ambrosio (1932–2021). *Notices of the American Mathematical Society*, 69(8), 1348-1351. https://dx.doi.org/10.1090/noti2530

Silfiana, N., & Widyastuti, W. (2021). Etnomatematika permainan kelereng sebagai media belajar matematika Sekolah Dasar. *Indonesian Journal of Islamic Elementary Education*, 1(1). https://doi.org/10.28918/ijiee.v1i1.3924.

Sugiyono. (2017). *Metode penelitian kuantitatif, kualitatif, dan R&D*. Bandung: Alfabeta.

Suprapto, N., Prahani, B. K., & Cheng, T. H. (2021). Indonesian curriculum reform in policy and local wisdom: Perspectives from science education. *Jurnal Pendidikan IPA Indonesia*, 10(1), 69–80. https://doi.org/10.15294/jpii.v10i1.28438

Supriyono, A. (2018). *Serunya Permainan Tradisional Anak Zaman Dulu*. Jakarta Timur: Badan Pengembangan dan Pembinaan Bahasa.

Suryawan, I., & Jaya, A. (2020). Permainan tradisional sebagai media pelestarian budaya dan penanaman nilai karakter bangsa. *Genta Hredaya,* 2(2), 1–10. Retrieved from https://jurnal.stahnmpukuturan.ac.id/index.php/genta/article/view/432/350

Taskiyah, A. N., & Widyastuti, W. (2021). Etnomatematika dan menumbuhkan karakter cinta tanah air pada permainan Engklek. *Jurnal Pendidikan Matematika (Kudus)* 4(1), 81-94. http://dx.doi.org/10.21043/jmtk.v4i1.10342

Taus, F. M., Nahak, S., & Deda, Y.N. (2022). Eksplorasi etnomatematika pada permainan tradisional congklak di desa Femnasi. *MES: Journal of Mathematics Education and Science,* 7(2), 1–9. https://doi.org/10.30743/mes.v7i2.4979.

Uskono, D., Deda, Y. N., & Amsikan, S. (2023). Eksplorasi etnomatematika pada permainan tradisional Kaneker di Desa Bitefa. *Primatika : Jurnal Pendidikan Matematika,* 12(1), 19–30. https://doi.org/10.30872/primatika.v12i1.1312

Yulita, R. (2017). *Permainan Tradisional Anak Nusantara*. Jakarta: Badan Pengembangan dan Pembinaan Bahasa

Yumiati, Y., Haji, S., & Yulitasari, E. (2023). Improving mathematics learning outcome through outdoor learning based on ethnomathematics of Bengkulu's traditional game 'Gotri Ayo Gotri. *JTAM (Jurnal Teori Dan Aplikasi Matematika),* 7(1), 23-33. https://doi.org/10.31764/jtam.v7i1.10189

Zayyadi, M., Hasanah, S. I, & Surahmi, E. (2018). Ethnomathematics exploration in traditional games as a form of student' social interaction. *JIPM (Jurnal Ilmiah Pendidikan Matematika),* 6(2), 125-132. http://doi.org/10.25273/jipm.v6i2.1826

Zulviansyach, A., Izza, N. Z., Risaldi, F.K., Hartini, S., & Hariastuti, R.M. (2023). Slingshot: Between traditional games and learning mathematics. *Journal of Mathematics Instruction, Social Research and Opinion,* 2(1), 75–88. https://doi.org/10.58421/misro.v2i1.68