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Ethnomathematics Exploration of Traditional Games of Kaneka and Mariam in Nangapanda, East Nusa Tenggara

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Abstract

This research explores the mathematical concepts and cultural values in the traditional games of Kaneka (Kelereng) and Mariam (Patok Lele). The type of research used is ethnographic research with a qualitative approach. The research instruments used consisted of main instruments and auxiliary instruments. The research location was Nangapanda sub-district, with the research subject being a 58-year-old traditional leader and 10-year-old traditional game player. Data collection techniques in this study used technical triangulation by observing, interviewing and documenting the same sources. The data analysis technique used in this study refers to the Spradley design, namely domain analysis, taxonomic analysis, componential analysis, and cultural theme analysis. The results showed that: (1) the traditional game of marbles (Kaneka) contains elements of the Ball and half ball shapes, distance elements, and counting points in-game activities, including addition operations; (2) the traditional game of Patok Lele (Mariam) contains elements of cylinder shapes, elements of Comparison, elements of direction, and calculating scores including addition and multiplication operations.

Keywords: Ethnomathematics; Traditional Games, Kaneka, Mariam

Introduction

Indonesia is a country that has abundant natural and cultural wealth. Not only is the natural beauty well known in the eyes of the world, but Indonesia also has a cultural diversity that we should be proud of. Each region or community has its pattern and culture that shows its characteristics. It can see from the various forms of cultural diversity that exist in Indonesia. One form of Indonesian culture is traditional games. Traditional games are games that children used to play in ancient times (Suryawan, 2020).

Traditional games are very popular with children aged five to ten years and over. The types of games chosen also vary; usually, boys prefer games such as marbles while girls prefer Engklek games, but there are traditional games that can be played by boys and girls such as catfish stakes, Congklak, Kites, etc. But now, these games are only a memory because

children rarely play them anymore. These traditional games were in great demand by children in the past, perhaps because, at that time, they were not as sophisticated as they are now. Now there are many games based on technology, for example, video games, online games, and so on (Suryawan, 2020).

According to Yulita (Yulita, 2017), many side effects arise from modern games—both health and psychological effects. In terms of health, the results are those who often play PlayStation tend to experience spinal injuries, especially if they are in front of the television screen for hours; it can cause damage to the eyes. Holding a stick and pressing a button for too long can also harm your health because these conditions can lead to arm vibration syndrome, which makes your hands vibrate constantly. From a psychological point of view, modern games can have a negative effect when interacting with society because someone tends to choose to be at home rather than outside the house, and victory is the main goal expected by gamers; if they have not yet won, then gamers will not feel happy. In modern gamers, players can do anything to win, which is not uncommon for even those who play cheating to win.

Modern games do not entirely negatively impact the players if the child is not too engaged in the game and can manage his time well—another case with traditional games. In the 1980s or before, children always played conventionally, giving an unforgettable impression to this day. In terms of social interaction, generally, traditional games require more than one player to play, so social interaction arises from these players. In modern games, some require social interaction, but no interaction in game online. Direct interaction can have a positive impact because children can learn to socialize and communicate with their surroundings.

Traditional games are full of healthy activities and make children think creatively. In conventional game activities, there are mathematical concepts that children are unaware of. The existence of mathematical concepts in traditional games is evidence that mathematics has an essential role in the lives of human groups. Mathematics is also beneficial for humans in general and students in particular. Mathematics is a mandatory subject that is important for students to learn and master (Friantini & Winata, 2019) because mathematics is something students often do in everyday life. The relationship between mathematics and daily life that has become entrenched is called ethnomathematics.

According to D'Ambrosio (D'Ambrosio 1985), ethnomathematics aims to recognize that there are different ways of doing mathematical activity by considering the mathematical knowledge developed in various sectors of society. So ethnomathematics has been known since the introduction of mathematics, not new knowledge. Learning that uses ethnomathematics can make students more active.

Ethnomathematics does not only explain mathematics, but ethnomathematics also recognizes the cultural values contained within it (Rosa & Orey, 2021; Scott, 2022). Ethnomathematics is essential because, in culture, there is an element of mathematics that can be used as a guide by teachers so that they can utilize traditional games as student learning materials. Various conventional games were in great demand by children in the past; perhaps, at that time, they were not as sophisticated as they are now. Now there are many technology-based games with ethnomathematics elements contained in certain cultures, especially traditional games in Nangapanda District, causing a lack of knowledge and understanding of

children regarding the mathematical concepts contained in the process of classic games. For this reason, it is necessary to explore conventional games that are almost extinct to be reminded again through learning at school.

Traditional games are one of the cultures and habits of children that need to be preserved (Supriyono, 2018; Yulita, 2017). One of the districts that still keep traditional games is Nangapanda District. Nangapanda District is one of 20 sub-districts in Ende District, East Nusa Tenggara Province. The types of classic games in Nangapanda District include *Kaneka* (marbles) and *Mariam*, and many more that cannot be mentioned one- One. Together. Several people or groups usually play traditional games.

The marbles game is a small round game made of clay or glass of various sizes; this game is played mainly by boys and can be player by more than two players. In the Nangapanda sub-district, the game of marbles is called *Kaneka*. Activities in playing Kaneka are also different, usually, the game starts by drawing a circle or triangle, but this is different from the Kaneka game. The initial step is to make a hole in the ground to insert the marbles. Each player has one marble. The next step is to create a straight line 1-3 meters from the hole to the starting point using the soles of the feet. The line is the path of a marble. The player whose marbles enter or are the shortest distance from the hole is the first player entitled to play.

Meanwhile, the player with the last order is the player who rolls the marbles that does not enter or has the farthest distance from the hole. The player whose turn it is must aim at the opponent's marbles from outside the hole; when the attack hits the opponent, the opponent's marbles cannot be play again or are said to be "dead". Players who have not put their marbles in the hole cannot attack and kill other marbles. The player is said to be finish when all the marbles have died, and only one is alive.

According to Khosasi et al. (Khosasi et al., 2018), playing with marbles can provide moral, social, emotional, and motor benefits. The moral advantage of playing marbles is practising being honest. The social-emotional benefits are increasing self-confidence, regulating emotions to focus on goals and training social skills. Meanwhile, the motor helps to prepare children's fine motor skills. The game of marbles introduces the concept of balls, tubes and lines. The marbles used by players are in the form of small balls. At the same time, the line is usually use as the net of a marble. The concept of distance is also used in marble games, namely when determining the order of players. Players usually only estimate who has the closest marble distance. However, if the distances look the same, then deciding which marble has the shortest distance is by measuring; the method of measuring is still very traditional, namely using a hand span.

The Patok Lele game is a game that uses two pieces of wood with a diameter of 3 cm, of which the length of the main or beater is one piece of wood with a height of 45 cm. Child catfish stakes with a height of 15 cm. in the early stages the players prepare an oval hole in the ground and a starting line of approximately 1.5 m and then whistle to determine who plays first, for example, team A as players while team B as guards.

So, exploring ethnomathematics in traditional games in Nangapanda District, it is necessary to study the mathematical concepts contained in the process of conventional games carried out by children to be usually use as a source of teaching materials or learning media in

learning fun mathematics. This study aims to describe the results of the exploration of mathematical concepts in the traditional games of *Kaneka* (marbles) and *Mariam* (Patok Lele) to find out the cultural values and benefits contained in the conventional games of *Kaneka* (marbles) and *Mariam* (Patok Lele) in Nangapanda District.

Methods

The type of research used is qualitative research with an ethnographic approach (Fauzi and Lu'luilmaknun 2019; Sugiyono 2017). This research held in January 2022 in the Community Area, specifically Nangapanda District, Ende Regency, East Nusa Tenggara Province. In this study, the research subject was one of the 58-year-old traditional leaders in the Nangapanda sub-district and two 10-year-old conventional game players. Hence, the number of subjects in this study was three people.

In this study, the initial stage was to select informants, namely children playing traditional Kaneka and Mariam games to obtain research data. Furthermore, the researcher prepared observation and interview guidelines to discover what to observe and what the researcher wanted to know. The next step is the researcher makes field notes containing all the essential things researchers in the field found, both obtained from informants in the form of interviews, observations and documentation. Furthermore, domain analysis was carried out based on the data obtained to make it easier for researchers to sort data related to research and find ethnomathematics activities or domains. Furthermore, data retrieval is carried out through observation, interviews and documentation to narrow and focus the research on the aspects studied according to the predetermined field. The research instruments used in this study were researchers, observation, and interview guidelines. Data analysis techniques in this study comprised domain analysis, taxonomic analysis, componential analysis and analysis of cultural themes (Sugiyono, 2017).

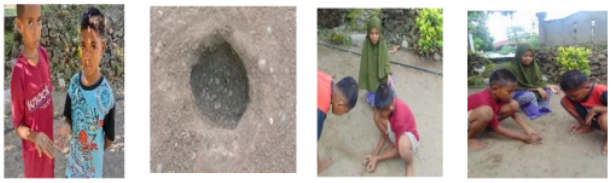
Results and Discussion

Following the research design, direct observations and interviews were conducted with children playing *Kaneka* and *Mariam* to obtain research data. During the observation, the researcher documented. On January 28, 2022, the researcher gave a research permit to the Nangapanda sub-district head; the Nangapanda sub-district suggested choosing a village to conduct the research, and the researcher chose Penggajawa Village as the research location. The Nangapanda District Head indicated that the researcher met directly with the Head of Penggajawa Village to ask permission to conduct research in Penggajawa Village. On January 29, 2022, the researcher gave a research permit to the Head of Penggajawa Village, Nangapanda District, the research location, as evidence of a request for permission to conduct research in Penggajawa Village, Nangapanda District. Then before completing the investigation, the researcher first worked a dialogue with the Pengjawa Village Head to suggest who to be the research subject. He offered several children as research subjects. Of the several children, the researchers chose four children, namely Allif (11 years) and Aril (9 years). The reason for selecting these two people is because they know how to play the game well and have an

excellent strategy to win the game. He also suggested one traditional leader as a research subject, Mr Husen (58 years), because he knew the game and how to play Congklak and Engklek because he had played it before. On January 30, 2022, the researcher visited the resource person and the children to ask about their willingness and time for the researcher to conduct interviews.

Furthermore, researchers began to conduct research on 2-5 February 2022. First, the researcher made observations of children playing *Kaneka* and *Mariam*. After the observation and interview process, the researcher typed the script neatly, then summarised the results of the interviews with the informants and research subjects, and carried out data reduction.

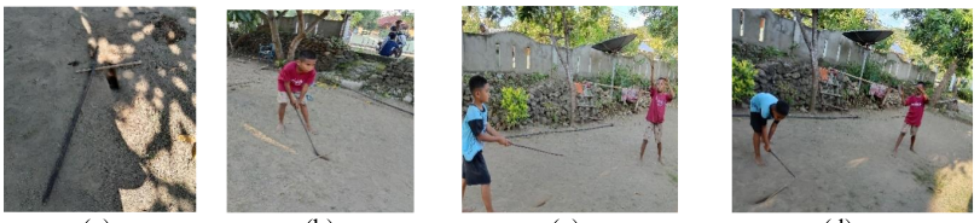
Observation of the shape and activity of the game of Kaneka (Marbles)



(a) (b) (c) (d)

Figure 1. Observation of Kaneka games

Observation of the form and activity of Mariam's game (Patok Lele)



(a) (b) (c) (d)

Figure 2. Observation of Mariam's play

From the research results through observation and interviews, researchers found mathematical concepts contained in traditional games in Nangapanda District. Among the marble games, the mathematical concept is located in the idea of geometric shapes, the concept of distance, and the concept of arithmetic operations. In the traditional game of catfish stakes, the mathematical concepts found are the concept of geometric shapes, the idea of Comparison, the concept of direction, and the concept of arithmetic operations. To better understand the research results, the investigation results will be explained in detail below. Based on the research data, the researcher carried out the stages of data analysis as follows:

Domain Analysis

The first stage in data analysis is domain analysis. Based on the study results, the researchers found ethnomathematics domains in the traditional games of *Kaneka* and *Mariam* (Patok Lele), namely: the activity of making plans and playing activities.

Taxonomic Analysis

The second stage in data analysis is taxonomic analysis. Based on the results of the study, which followed the activity of making design and playing activities in the traditional games of *Kaneka* and *Mariam*, namely:

1. In making construction plans, the tools used in the game *Kaneka* and *Mariam* and the types of game forms *Kaneka* and *Mariam*.
2. In activities, rules and techniques are found in playing *Kaneka* and *Mariam* games.

Component analysis

The third stage in data analysis is compensatory analysis. In this compensatory analysis, the researcher looked for more detailed data from the game *Kaneka* and *Mariam* to find ethnomathematics in mathematical concepts. Therefore the researcher determines the components that are following the activity of making design and play activities in Table 1.

Table 1. Component Analysis Results.

Traditional Game	Component Analysis	
	Design and Build Activity	Play Activity
Kaneka (Marbles)	The tools used in the game *Kaneka* (marbles) are *Kaneka* balls and *gomo* (holes).	There are specific techniques and rules in the kaneka (marbles) game, namely the positioning of the hands and feet when playing *kaneka* (marbles).
	The form of the game Kaneka (marbles) is a hole in the playing field	
Mariam (Patok Lele	The tools used in the game *Mariam* (Patok Lele) are pieces of wood and pieces of parent and child bamboo	There are specific techniques and rules in the game *Mariam* (Patok Lele), namely the movement of the position of the hands and feet when playing the game mariam (Patok Lele).
	The form of the *Mariam* game (Patok Lele) is a hole in the playing field	

The concept of mathematics in the traditional game of *Kaneka*

Based on the research results, it is known that mathematical concepts are contained in the *kaneka* game. Some Mathematical concept in the traditional game of Kaneka that finding in this investigation are Geometry concept, Distance concept, and Numbers Concept.

Geometry concept

First concept is ball. The shape of the Ball is in the form of the *Kaneka* that is played. A sphere is a curved side shape bounded by a curved plane. The Ball is obtained from a semicircle rotated one complete rotation or 3600 on the centre line. Second cocept is half ball. The half-ball shape is in the hole made to insert the kaneka. A half ball is part of a whole ball cut into two equal pieces; in other words, a half ball is a ball in half.

Distance concept

Kaneka's game activity includes the concept of distance, that is, in the preparation stage, it can be seen that the players make a line to determine the distance when they roll Kaneka into the hole. In Addition, the first player is determined based on the variety with the closest distance to the hole or the marbles inserted into the hole.

Numbers Concept

In learning mathematics, the concept of adding numbers through the game of marbles is when players count the number of marbles from each player. Apart from that, in-game activities, when the opponent can put Kaneka into the hole and start aiming (*kuti*) at various opponents and hitting them, the points earned by the player increase. Players who can put Kaneka into the hole at the start of the game then the player get 10 points, and if the player aims at (kuti) various opponents and hits, the player's points increase for each aim (*kuti*) and hits the player gets one point so, 10 + 1 + 1 + ...n =. According to Ulya (Ulya & Istadi, 2022), Addition is a rule that relates each pair of numbers to other numbers.

We found mathematical concepts in the exploratory activities of traditional marble games, namely the concepts of shapes, distances and numbers. The idea of mathematics has as an innovation in learning mathematics (Hariastuti, 2017).

Mathematical concepts in the *Mariam* traditional game

Based on the research results, it is known that mathematical concepts are contained in the kaneka game. Some Mathematical concept in the Mariam traditional game that finding in this investigation are Geometry concept, Comparison concept, Numbers Concept , and Direction concept.

Geometry concept

The first concept in geometry is tube. The shape of the tube is found in the pieces of bamboo "children" of catfish stakes. A cylinder is a three-dimensional geometric shape formed by two identical parallel circles and a rectangle surrounding the two circles. Second is elliptical. Elliptical or oval shape found in the hole made above ground level to play mariam. In mathematics, a regular ellipse or oval is a circle-like figure extended in one direction. An ellipse is an example of a conic section and can be defined as the locus of all points in a plane that have the same distance from two predetermined fixed points (called foci). In Indonesian, apart from the standard terms ellipse or oval, equivalent terms are also often known: ellipse (or just oval), round oblong, and elliptical.

Comparison concept

the concept of Comparison is found in the size of Mariam's "child" and "parent" pieces of wood. The "mother" piece of wood has a length of 45 cm while the "child" piece of wood is 15 cm. Comparison is a technique or way to compare two quantities. The comparative concept found

is on the pieces of wood used in *Mariam's* games. The "parent" piece is longer than the "daughter" piece.

Numbers Concept

First concept in number is addition. The concept of adding numbers through the mariam game in learning mathematics is that when the game is about to end, the player will count the total score from the catch of Mariam's "kids" wood and the number of points earned during the game activity, and a sum process occurs. According to Taus (Taus et al., 2022) addition is a rule that relates each pair of numbers to other numbers. The Addition also has several properties: the nature of exchange, identity, and grouping. The second is multiplication. The concept of multiplying numbers through the mariam game in learning mathematics is when the player calculates the distance between the "child" pieces of wood from the hole using the "parent" pieces of wood, and then a multiplication process occurs. The concept of multiplication is another form of repeated Addition or Addition of the same number (Ramadhina et al., 2021; Sumiyati & Purwati, 2022).

Direction concept

Mariam's game has the concept of direction; namely, when the player hits the "child" piece of wood using the "parent" piece of wood, the "child" piece of wood is thrown up after that, the player hits again to the side. Then two directions of strokes are made: vertical (up) and horizontal (sideways). The existence of the concept of direction can be connected with the coordinate axes in two-dimensional space (cartesian coordinates).

The mathematical concepts we find in the traditional game Patok Lele are geometrical concepts, measurements, and numbers. These mathematical concepts must be used to compile mathematics learning with ethnomathematics nuances (Setiyadi, 2021).

Nangapanda Traditional Game Cultural Values

Traditional games are old games that were passed down by our ancestors and are still preserved today. Some cultural value that found in this study are social value, honesty value, nationalism value, and discipline value.

Social value

Based on the study's results, many children's activities show social value in the traditional games of *Kaneka* (marbles) and Mariam. The number of interactions children make during the game shows that conventional games teach them to interact well with other children. Children who get used to frequent interaction with other people from an early age will usually find it easy to establish good communication and interaction with people around them or people they have just met in their lives.

Honesty value

Based on the study's results, many children's activities One of the activities that contain the value of honesty in traditional Kaneka games, the rules in conventional Kaneka games are when aiming at Kaneka's opponent. If at the time of aiming at *Kaneka,* the player does not hit Kaneka's opponent, the player is said to be killed, and the opponent playing continues the game and must be patiently waiting for the next turn. If wrong one child plays cheating, then the child does not comply with the rules that have been set, and the other child warns him that this is not good, but the child does not continue the game and repeats it in the next round, this indicates that the child is being honest in the game of kaneka (marbles)). This activity shows that the traditional game of kaneka (marbles) teaches the value of honesty.

Nationalism value

Love for the motherland is a positive attitude to contribute positively to building the nation and state. Love of country refers to a manner of thinking, behaving, and acting that demonstrates loyalty, care, and deep admiration for the nation's language and physical, social, cultural, economic, and political environment. Many children's activities One of the mariam game activities is that children like mariam games because in mariam games they can have fun with their friends. The mariam games that children play do not mix with modern games that are currently developing, and they still maintain cultural values in these games. The classic match is perfect for instilling a love for the homeland's culture.

Discipline Value

Based on the study's results, many children's activities show the value of discipline in the traditional games of *Kaneka* and *Mariam*. One of the activities that contain disciplinary matters in the conventional game of *Kaneka* is the queue of the order of players when rolling the kaneka ball towards the hole, applying the cultural values of discipline. Every time they decide their turn before playing and get their turn as determined by rolling the kaneka towards the hole, each child always receives the order of play they get, and no child does not receive the charge that has been determined. In Addition to cultural values, there are also benefits found from the movement of rolling Kaneka into the hole, namely that children can know and learn mathematical concepts contextually, namely the concept of distance.

Traditional games have a role in preserving the cultural values of a community group (Siregar & Lestari, 2018). In Addition, children can have social interactions from an early age (Zayyadi et al., 2018). Some cultural values that need to be preserved in the traditional games of *Mariam* and *Keneke* in the Mangapanda community are social values, honesty, sportsmanship, love for the motherland and discipline. The mathematical concepts found in the traditional game *Kelereng* and *Patok Lele* are geometric concepts, distance concepts, comparison concepts, the concept of arithmetic operations, and the concept of direction.

We hope that the findings of this mathematical concept will be used as a starting point in learning mathematics. Traditional games are full of cultural values and implied mathematical concepts in them. We highly recommend conducting further research that explores cultural

values and making classic games the starting point for learning mathematics at school (Prahmana, 2022; Prahmana et al., 2023).

Conclusion

Based on the discussion above, we conclude that the ethnomathematics concepts in the traditional Kaneka and Mariam games in the Nangapanda sub-district, especially in Penggajawa Village, are 1) the traditional Kaneka game contains mathematical concepts, namely: the concept of geometric shapes, the concept of distance and the concept of arithmetic operations. 2) Mariam's traditional game also contains mathematical concepts, namely: the concept of geometric shapes, the concept of Comparison, the concept of arithmetic operations, and the concept of direction. In Addition to mathematical concepts, there are also cultural values from traditional games. The cultural values are the values of discipline, the importance of honesty, social values, and the values of love for the motherland. At the same time, the benefits derived from traditional games include training children's ability to think creatively, making them physically healthy, and training them to wait for their turn while playing patiently.

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Conflicts of Interest

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

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