ETHNOMATHEMATICS IN THE CANANG TRADITIONAL GAME OF RIAU ISLANDS

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Abstract

Ethnomathematics is a concept that links culture and mathematics and has characteristics that support each other. The presence of mathematics with cultural nuances can make a significant contribution to mathematics learning. Traditional games are one of the various cultures that grow in Indonesia. The mathematical concepts in traditional games show that traditional games can be a medium for conveying mathematical concepts to students. This study aims to describe and examine more deeply the mathematical activities and concepts contained in the traditional game of *canang* originating from Bunguran Barat, Pulau Tujuh, Riau Islands. This research is qualitative research with the ethnographic method. This research uses ethnographic methods with ethnomathematics specifications. The data collection techniques used are direct observation, interviews, and documentation. The results showed mathematical activities such as counting, measuring, playing, explaining/grouping, and comparing. In addition, there are also mathematical concepts in the form of whole number operations, comparison, displacement, and distance.

Keywords: Ethnomathematics; traditional game of *canang*; math concept.

Abstrak

Etnomatematika merupakan sebuah konsep yang mengaitkan antara budaya dan matematika yang dipelajari serta memiliki karakteristik yang saling mendukung. dengan hadirnya matematika yang bernuansa budaya, dapat memberikan sebuah kontribusi yang besar terhadap pembelajaran matematika. Permainan tradisional merupakan salah satu ragam budaya yang tumbuh di Indonesia. Konsep-konsep matematika yang terdapat pada permainan tradisional menunjukkan bahwa permainan tersebut dapat menjadi media penyampaian konsep matematika bagi peserta didik. Tujuan penelitian ini adalah mendeskripsikan serta mengkaji lebih dalam aktivitas matematis dan konsep matematika yang terkandung dalam permainan tradisional canang yang bersasal dari Bunguran Barat, Pulau Tujuh, Kepulauan Riau. Penelitian ini merupakan penelitian kualitatif dengan metode etnografi. Penelitian ini menggunakan metode etnografi dengan spesifikasi etnomatematika. Teknik pengumpulan data yang digunakan adalah observasi secara langsung, wawancara, dan dokumentasi. Hasil penelitian menunjukkan bahwa terdapat aktivitas matematika seperti menghitung, mengukur, bermain, menjelaskan/mengelompokkan, dan membandingkan. Selain itu juga, terdapat konsep matematika berupa operasi bilangan bulat, perbandingan, perpindahan dan jarak.

Kata kunci: Etnomatematika; permainan tradisional canang; konsep matematika

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One of the countries that has a variety of cultures is Indonesia. The culture in Indonesia is very different from Western culture because there are differences in experience, hierarchy, belief systems, religion, ethnicity, and others (Kusumohamidjojo, 2000). This makes Indonesia a complex and exciting country. The culture in Indonesia develops from time to time with various preservation efforts so that the next generation can enjoy it. Culture is a pattern of habits resulting from the human mind that can help

humans carry out their activities (Febrian & Astuti, 2022). The culture between community groups has differences. Culture develops in a community group following the situation and environmental conditions around the community group's environment, which is why the culture of one group with another group can be different.

Traditional games are part of the variety of cultures that grow in Indonesia. Traditional games are activities that are carried out without coercion, bring a sense of excitement in a pleasant atmosphere based on the traditions of each region in the environment, are played using tools or not using tools, and are carried out by the rules that have been agreed upon before the game starts, such as rules, fields, number of players, and so on (Widodo, P., & Lumintuarso, 2017). Traditional games have cultural values that must be preserved and known by children. In addition to having cultural values, some traditional games also contain learning concepts, including mathematics learning concepts. The mathematical concepts in traditional games show that traditional games can be a medium for conveying mathematical concepts to students, especially for students still in the concrete operational stage. This is because traditional games are easy to understand, familiar with children's daily lives, and a learning tool that explains the relationship between environmental culture and mathematics (Hariastuti, 2016).

An approach that can be used in explaining the reality of the relationship between environmental culture and mathematics when teaching is ethnomathematics (Rusliah, 2016). Ethnomathematics was first introduced by D'Ambrosio, a Brazilian mathematician, in 1977. Linguistically, the word "*ethnic*" comes from the word "*ethnic*," which is defined as something comprehensive that refers to the sociocultural context, including language, jargon, behavioral codes, myths, or symbols. (D' Ambrosio, 1999) says, "*ethnomathematics as modes, styles, and techniques (tics) of explanation, of understanding, and of copying with the natural and cultural environment (mathema) indistinct cultural systems (ethno)"*, which means ethnomathematics as modes, styles, and techniques of explaining, understanding, and coping with the natural and cultural environment (*mathema*) in different cultural system (*ethno)*. According to Fauzi & Lu'luilmaknun (2019), ethnomathematics is one form of learning approach that links local wisdom in learning mathematics. With ethnomathematics, mathematical concepts can be studied in cultural practices. Through ethnomathematics, students will better understand how their culture is related to mathematics, and educators can instill the nation's cultural values, which impact character education.

One of the traditional games that can be identified regarding mathematical concepts is the traditional game of *canang*. This is a folk game from West Buguran, Tujuh Island, and Riau Islands. In ancient times, this game was usually played by children in fishing villages. This game was also favored by the children of the nobility, especially the childs and daughters of Datuk, who ruled during the reign of the Sultan of Riau in the XVIII century. However, over time everyone, children

and adults, is free to play this game as long as they follow the applicable rules. This game is also often found in various regions in Indonesia with different names or terms, such as *gatrik* in West Java, *tak tek* in Bangka Belitung, *bethink* in Central Java and Yogyakarta, *patok lele* in Madura and *gelengkue teu peu poe* on the coast of Langsa, Aceh.

Generally, the *canang* game requires a stick made of wood measuring approximately 30 cm for the *induk canang* and 5 cm for the "*anak canang*". In addition, the player must also make a hole first to install the *anak canang* that will be thrown using the *induk canang*. The player must be able to bounce the *anak canang* placed in the hole to be thrown far. This discussion contains concepts of comparison and length measurement used in determining the stick's length in this *canang* game. Although generally similar, each region is unique regarding rules, how to play, and naming.

Some previous studies have also discussed the elements or concepts of mathematics in the traditional game of *canang* with different names or terms according to the region. The research conducted by Wahyuni (2018), aims to describe the ethnomathematics contained in the *gelengkue teu peu poe* game in Langsa coastal children. The results of this study found that there are concepts of supposition, measurement, geometry, probability, and numerators. Other research conducted by Karina et al., (2021)**,** which aims to find out the content of mathematical elements in the *patok lele game*, obtained the results that the *patok lele* game contains elements of unit length, recognizes the shape of the tube, and calculates scores including the operations of addition, multiplication, subtraction and division. Research conducted by Hariastuti (2016), which aims to determine the mathematical concepts contained in the traditional game of lele patil, obtained the results that in the traditional game of *patil lele*, there are concepts of measurement, comparison, addition, multiplication, and the concept of direction in the coordinate plane.

Based on the background and some previous studies that have been described, researchers want to review the Riau Islands version of the game called *canang* as well as to see if there are similarities or differences in research results with previous studies. Because of this potential, this research is considered necessary in order to find out and examine ethnomathematics in the traditional game of *canang*. The aim is to describe the mathematical elements contained in the traditional game of *canang* and remind the community of this traditional game of *canang*.

METHODS

This research uses ethnographic methods with ethnomathematics specifications. Ethnography is investigating the culture of people in their natural environment (Ghony, D. M., & Almanshur, 2014). Ethnography is one of the methods of revealing and understanding humans and their culture, and ethnographic theory can develop from time to time along with the development of science (Brier & lia dwi jayanti, 2020). Ethnography is an empirical and theoretical approach to a culture based on

research in the field that has the aim of obtaining descriptions and analysis. The ethnographic approach, in general, is observation, participating as part of field research. Ethnomathematics is a science used to understand how mathematics is adapted from a culture. The use of mathematics from a cultural group can be considered as a study of the identification of mathematical ideas found in each culture. This research uses an exploratory, descriptive type to reveal and obtain information thoroughly, broadly, and deeply (Prahmana, 2017). The descriptive research conducted is not intended to test certain hypotheses but aims to find out the mathematical activities and mathematical concepts contained in traditional *canang* games in the West Bunguran area, Pulau Tujuh, Riau Islands.

The research was conducted by collecting data in the form of the basic concepts of traditional *canang* game and the methods/rules of the game. Data collection was carried out with three techniques, namely direct observation techniques, interview techniques, and documentation. Therefore, the researcher is the main instrument. Researchers here prepare research instruments in the form of observation sheets, interview guides, and video recordings. The researcher observed how the children played the *canang* game without them realizing there were mathematical elements and documentation related to how this game was carried out. For interviews, researchers interviewed children who were the object of the research, and they had often played the *canang* game. The data that has been collected is analyzed qualitatively so that it can be determined the mathematical concepts contained in the traditional game of canang. The data analysis technique used for this research is *Spradley,* where *Spradley* divides qualitative data analysis based on the stages of qualitative research. The stages carried out are domain analysis, taxonomy analysis, componential analysis, and cultural theme analysis (Spradley, 1975).

Although *canang* originated from Tujuh Island, the game has spread widely to various areas of the Riau Islands, one of which is in the Sungai Lekop area, Bintan Regency. The subjects or informants in this study were children in the Jalan Musi area of Sungai Lekop Village. Determination of research subjects using a purposive sampling technique. The purposive sampling technique is a sampling technique based on the characteristics or objectives set by the researcher beforehand (Dantes, 2012), so the subjects in this study were children who were adept at playing *canang*.

Table 1. Review of Ethnographic Studies of *Canang* Games

Leading Question	Initial Response	Analysis Steps	Viewpoint	Activities
Where to start looking?	In the activity of playing *canang* bychildren in Sungai Lekop Village	Domain	Culture and culture	Conduct observations and interviews with children in Sungai Lekop Village
How do I see the making of the *induk* and *anak canang* and the *lubang canang*?	Looking at the aspect of making *induk canang* and *anak canang* and *lubang canang* by children in Sungai Lekop Village, where thereis potential for mathematical practice in it	Taxonomy	Alternative thinking, art an ethnographic description	Determine the potential ideas, methods, or techniques children use in making *induk canang* and *anak canang* and *lubang canang* related to math practices or activities.
What is the evidence that the *canang* game has a mathematical concept?	Evidence (mathematical activities or concepts as a resultof alternative thinking)	Compo-nential	Mathematics and the philosophy of mathematics	Recognize and distinguish the potential of specific characteristics in *canang* game activities related to mathematics
What is the meaning of the *canang* game?	Cultural values learned	Cultural themes	Anthropology	Describe ethnomathematics in *canang* games by focusing on the relationship between activities and mathematical ideas or concepts.

RESULTS AND DISCUSSION

This *canang* game is one of the traditional Malay games, especially in West Bunguran, Pulau Tujuh, and Riau Islands. In ancient times, this game was often played by fishermen's and farmers' children. This game is the original game of the archipelago because it is spread in various regions and has different names in each region. For example, *benthik* from Yogyakarta, *gelengku teu pe poe* from the coast of Langsa, *gatrik* from Sunda, and so on. This research only focuses on traditional Pulau Tujuh, Riau Islands games, namely the *canang* game. In addition, the *canang* game has also spread

throughout the Riau Islands, one of which is in the Sungai Lekop area. The sequence of this game can be seen in the following diagram.
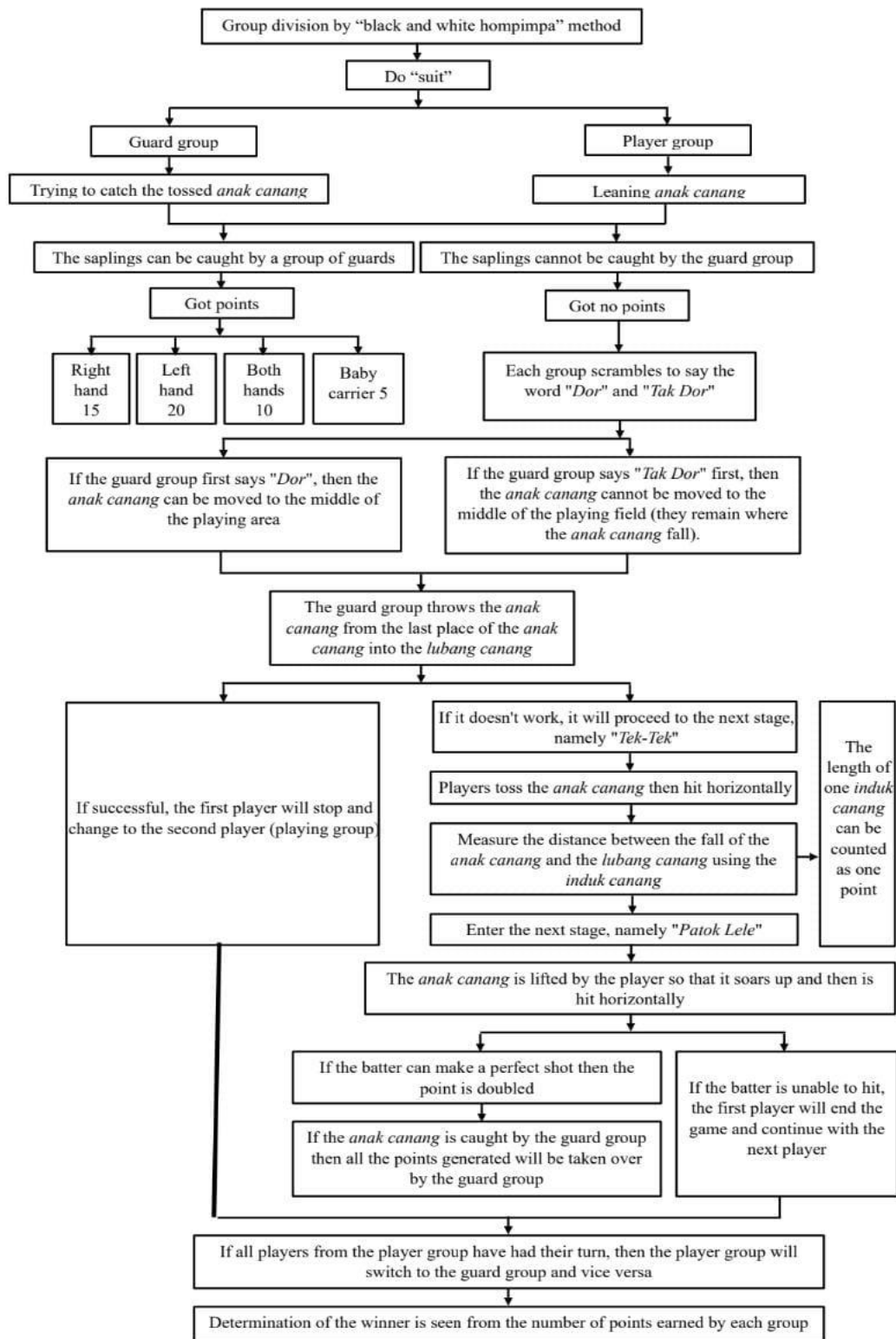

Figure 1. Diagram of *canang* game sequence

1.   Game Tools and Materials

In this *canang* game, the tools used are two pieces of wood or tree branches that can be made from new bamboo. The two pieces of wood have different sizes whereas the long wood, known as the *induk canang* or beating wood, has a length of 30 cm and a diameter of 2 cm. Meanwhile, the small wood known as *anak canang* has a length of 6 cm and a diameter of 2 cm. In addition to the two pieces of wood to play this game, there is also a *lubang canang* with a length of 13 cm and a width of 3 cm. The mathematical aspect that emerges in determining the material fund tools in the *canang* game is the aspect of measuring. In addition, the difference in the size of the *anak canang* and the *induk canang* has a mathematical activity in the form of compare where; the *anak canang* has a shorter size than the *induk canang*. Hence, the mathematical concept that emerges is the concept of comparison. The difference can be seen in figure 1.
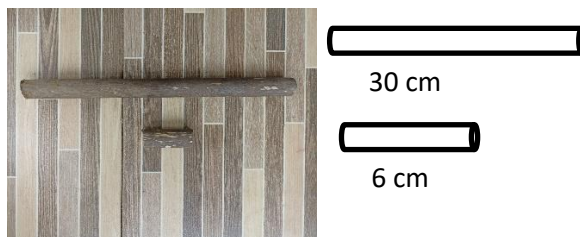

Figure 2. *induk* **and** *anak canang*

Figure 3. *lubang canang*

2.   Analysis of Mathematical Activities and Mathematical Concepts

This *canang* game is usually played in groups where two groups are playing this game. Usually, the number of members of each group is not limited, but group members are sought to play well and sportsmanship in this game. The division of groups using black and white *hompimpa* can be seen in figure 3, where the white palms will become one group, and the black palms will become one group. The two groups formed earlier then chose a leader to do a *suit* to determine which group would play first and which would stand guard. After determining which group will play first, the order of the members who will play first will be carried out to bounce the *anak canang* using the *induk canang* from the *lubang canang*. Members who get their turn first must pass the first stage to get to the next stage. So determining the number of players is a counting activity and probability, which is part of the counting aspect.

Figure 4. *Hompimpa*

Figure 5. *Suit*

In the first stage, the first player in the playing group bounces the *anak canang*. If the bouncing *anak canang* is likely to fall in a distant place, the playing group will say "*tak dor*", while the group on guard will say "*dor*." The meaning of the word "*tak dor*" is a situation where the *anak canang* that falls in a distant place is not moved to the center of the game arena, making it difficult for the group on guard to throw the *anak canang* into the *lubang cannag*. Meanwhile, the word "*dor*" means a situation where the *anak canang* that falls in a distant place can be moved to the center of the game arena, making it easy for the group on guard to throw the *anak canang* into the *lubang canang*. The word "*tak dor*" or "*dor*" can be applied in this canang game by judging who is faster between the group playing and the group on guard in saying the word. In figure 5, when the *anak canang* is bounced, the *anak canang* will move according to the direction of the bounce, so there is a concept of displacement and distance that occurs in the *anak canang*.

Figure 6. Bounching the Canang

Figure 7. Catching the *anak canang*

However, if the guard player can catch the bouncing *anak canang*, then the guard group will get points. The points obtained if the guarding group members can catch the *anak canang* are: (1) if the member can catch with one hand (left), then the points obtained are 20 points (2); if the member can catch with one hand (right), then the points obtained are 15 points; (3) if the member can catch with both hands, then the points obtained are 10 points; and (4) if the member can catch by holding the *anak canang*, then the points obtained are 5 points. The math activity that appears in determining points in the *canang* game is the activity of adding up with the aspect of counting.

If the *anak canang* is not caught by the guarding group, the guarding group does not get points, and the *anak canang* will be thrown by the guarding group members from where the *anak canang* fell to the *lubang canang*. If the thrown *anak canang* enters the *lubang canang*, the first

player from the playing group will stop and change to the second player from the same group. Conversely, if the thrown *anak canang* does not enter the *lubang canang*, this game will enter the next stage, namely the "*tek-tek*" stage.

Figure 8. Throwing of *Anak Canang*

Figure 9. *Tek-tek*

In this "*tek-tek*" stage, the player who plays floats the *anak canang* then quickly hits the *anak canang* vertically (*tek-tek*) twice without falling, followed by a third blow horizontally which is done as hard as possible to reach the furthest distance. After that, the distance between the fall of the *anak canang* and the *lubang canang is* measured using the *induk canang* as a measuring tool. In measuring, the length of one *induk canang* can be counted as one point, an additional point for the playing group.

Figure 10. Calculating distance

Figure 11. *Patok Lele*

Next, enter the last stage, the "*patok lele*" stage, where the *anak canang* is placed horizontally above the *lubang canang* and then levered with the *induk canang* until it soars upwards and then hits horizontally as far as possible. If the batter can make a perfect hit, the point doubles. However, if the *anak canang* is caught by the player on guard, all the points generated will be taken over by the group on guard. However, if the batter cannot make a hit, the game ends, which is played by the first player and continued by the next player.

In the *canang* game, the activities of calculating distance and points by using the tools used in the playing process. Point calculations can be calculated using a predetermined stick. For example, if the guard misses the *anak canang* thrown by the player, then the points can be measured using the size of the *induk canang* namely, one point for one side of the *induk canang*.

If all players from the playing group have had their turn to play, then the playing group's opportunity has been completed, and the playing group will switch to the guarding group and vice versa. The determination of the winner is seen from the number of points earned by each group. For example, in the results of observations, researchers know the final points of each group, namely group A getting a final point of 400 points while group B gets a final point of 350 points, so the winner in the game is group A. In addition, this also proves that determining the winner can be seen from the comparative value of the two groups. The comparison between groups A and B is 400: 350, then simplified to 8: 7.

Table 2. Recapitulation of the Ethnomathematics Search Results of the *Canang* Game

Domain	Math Ideas, Methods, Techniques	Math activity in *canang* game	Math Concepts
Counting	- Division of group members - Number of points	- There are counting and enumeration activities in the division of equal groups. In addition, there is the activity of calculating the probability of each member of the two groups existing - Count the number of points contained in the addition activity, which is the concept of whole number operations.	Concept of Addition, Enumeration
Measuring	What is the length of the *canang*	The size of the *induk canang* is 30 cm, while the *anak canang* is 5 cm.	Concept of length Measurement
Comparing	Size comparison of *induk* and *anak canang* Winner's benchmark	Comparing the *anak canang* with the *induk canang*. The *induk canang* is longer than the *anak canang*. The ratio is 30:5, simplified to 6:1, and In determining the winner, it can be seen by comparing the points of group A and group B. Hence, the math activity seen is the activity of comparing.	Concept of comparison

Playing	- Rules of the *canang* game - Strategy in *canang* game	- Determining the number of pointsdepends on the agreement of bothgroups (there is the concept of addition, namely counting and counting). In addition, determining points by countingusing the *induk canang* - Bouncing the *canang* at a long distance from the opponent (there is the concept of displacement and distance)	- Concept of Addition - Concept of Displacement and distance

Based on the research results, there are several mathematical activities and mathematical concepts in these traditional games derived from the activities of counting, calculating, measuring, and comparing. The first activity is counting and calculating; in the game, the player uses numbers to count and calculate. Traditional games are helpful in introducing basic math concepts such as numbers because by teaching counting and recognizing numbers, children will have basic calculation skills before entering the next level (Fabiana Meijon Fadul, 2019). Players in the *canang* game consist of two groups, so it is necessary to determine the number of players and points. There is the concept of probability in determining the number of players, and determining the number of points is calculated using the *induk canang* as a non-standard unit. This contains counting and counting activities with the mathematical concepts of integer operations and probability.

Other math activities we can find are measuring and comparing activities, measuring and comparing activities that have a relationship with each other. According to (Karina et al., 2021), measuring activity is comparing a quantity with a similar quantity as a unit and producing a measure consisting of value and unit so that the activity of comparing is part of the activity of measuring. In the *canang* game, *anak canang* and *induk canang* are measured by different sizes and produce a comparison in which the *induk canang* is more significant than the *anak canang*. In addition, determining the winning group in the game is determined by looking at the final score; if a group is more significant than the opposing group, that group is the winner. These results also show that the *canang* game has to measure and compare activities with the mathematical concept of comparison.

The *canang* game is rich in mathematical activities and concepts such as counting, numbering, integer operations, probability, measurement, comparison, and distance and displacement so that the game can contribute to the understanding of mathematics learning concepts. In addition, with the

same research object on the game *patil lele, gatrik, benthik*, and *gelengku teu pe poe*. In learning mathematics, *patok lele* games can be used to concretize the concepts of measurement, comparison, whole number operations in addition and multiplication, and the concept of direction. For this reason, teachers in schools design a form of learning tailored to the mathematical concepts to be conveyed (Suparyanto dan Rosad 2020). The *gatrik* game originating from Sunda has a mathematical concept based on the results of research conducted by Handayani and Irawan; from these results, it is found that children can count math numbers and distinguish odd and even numbers, which are part of the concept of calculation and numeration (Handayani & Irawan, 2021). *Benthik* games from Yogyakarta have mathematical concepts such as number concepts, distance, flat shapes, and lines and angles (Astuti, 2021). Another study, namely the *gelengku teu pe poe* game originating from Aceh, found that team formation begins with a finger suit which shows the concept of probability, the concept of geometry in the selection of wood used, and the concept of measuring and counting, which is seen in the activity of measuring and counting points (Wahyuni, 2018). From the results of this study, it is found that counting and measuring activities are an inseparable part of human activities in everyday life.

Ethnomathematics is the study of mathematics found in a culture. Mathematics can be connected to the region's culture so students can feel it daily. In learning activities, many learning theories can make it easier for students to understand. However, selecting the correct and appropriate learning theory in the learning process is very necessary. The learning theory is a method used to describe a child's learning process. One of the learning theories is a constructivism learning theory which is the knowledge of the students themselves involving experiences in the surrounding environment as a learning process. So that by using this constructivist learning theory, ethnomathematics can be easily connected between mathematics subject matter at school and students' experiences in the surrounding environment.

The elements of mathematics in the c*anang* game played by the children of the Riau Islands include the concepts of integer operations, comparison, displacement, and distance. The concept of integer operations is found in counting the number of points in the addition activity. Then, the concept of comparison is comparing the *anak canang* with the *induk canang*, where the *induk canang* has a more extended size than the *anak canang*. Meanwhile, the concept of displacement and distance can be seen when bouncing the *canang* at a distance away from the opponent. Thus, the application of constructivist learning theory has inadvertently been carried out by children who play *canang* because they can find the relationship between *canang* games and the concept of learning mathematics at school.

The results of this study provide information about the existence of mathematics in the practice of community life, especially in traditional games. The phenomenon of daily life that contains mathematical activities can be a didactical phenomenon that is a source of inspiration for

mathematics learning (Febrian et al., 2022). Therefore, ethnomathematics is very well used in mathematics education. Ethnomathematics is very suitable for helping students understand mathematical concepts. Several studies have shown that integrating ethnomathematics into mathematics learning has produced significant results. The study of ethnomathematics is beneficial for teachers and students in understanding mathematics with ideas, ways, and techniques used in real-life contexts to increase students' interest, understanding, and creativity (D'Ambrosio, 2007).

CONCLUSIONS

Based on the results and discussion previously described, in this *canang* game, there are mathematical activities and mathematical concepts. In this *canang* game, there are mathematical activities in the form of counting, measuring, and comparing activities. Mathematical concepts are also found in the activities in the *canang* game. The existing mathematical concepts are the concept of probability, the concept of whole number operations such as addition, the concept of comparison, and the concept of displacement and distance. The exploration of mathematics in this *canang* game provides an experience that math learning is not only done at school but also in daily activities such as during play.

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