

STUDY OF ETHNOMATHEMATICS EXPLORATION OF ARUL GAMES LAMPUNG CULTURE

Indah Cahyaningati¹,Hafsah Adha Diana² ^{1,2}Universitas Media Nusantara Citra, Jl. Arteri Kedoya, Jakarta Barat, Indonesia Email: indahcahya769@gmail.com

Article History	Abstract. This research aims to explore the mathematical concepts in traditional
	Arul games. This research is explorative qualitative research with an
Received: 29-12-2021	ethnographic approach. Data collection techniques used are observation,
	interviews and literature studies. The results showed that in traditional games,
Revision: 13-04-2022	Arul found mathematical elements including the division, fractions,
	comparison, the revival of two circles, the determination of the centre point of
Accepted: 15-04-2022	the circle, the unit is not standard, half hollow ball, circle, chance, distance,
Published: 29-04-2022	speed and time. The mathematical elements contained in traditional games can
	be used as learning materials in the classroom to be more contextual and a
	means of preserving local culture.
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	Keywords: Ethnomathematics, Traditional Game, Arul Game
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	Abstrak. Tujuan dari penelitian ini adalah mengeksplorasi konsep matematika
	yang ada pada permainan tradisional Arul. Penelitian ini merupakan penelitian
	kualitatif eksploratif dengan pendekatan etnografi. Teknik pengumpulan data
	vang digunakan yakni observasi, wawancara dan studi literatur. Hasil penelitian
	menunjukan bahwa pada permainan tradisional Arul ditemukan elemen-elemen
	matematika diantaranya pembagian, pecahan, perbandingan, kesebangunan dua
	buah lingkaran penentuan titik pusat lingkaran satuan tidak baku setengah
	hola berongga lingkaran peluang jarak kecenatan dan waktu Unsur-unsur
	matematika yang terdanat nada permainan tradisional danat dijadikan sebagai
	bahan nembelajaran di kelas sehingga lebih konstekstual dan sarana dalam
	melestarikan hudaya lokal
	morodu indi ouduju lokui.
	Kata Kunci: Etnomatematika, Permainan Tradisional, Permainan Arul

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INTRODUCTION

21st-century learning emphasizes the 4C skills of critical thinking and problem-solving skills, communication, collaboration skills, creativity and innovation skills (Darise, 2019; Fernandes, 2019). he Core Competency of mathematics learning Curriculum 2013 revision also emphasizes associating social, cultural, economic, and other contexts with the learning process. The competence of the curriculum 2013 revision requires strengthening in the formation of 4C skills rather than just transferring science. 4C skills need to be integrated because of the strengthening of soft skills that are more used in everyday life than hard skills

(Darise, 2019). The integration is intended to improve learners' understanding of applying real-life mathematics to classroom learning.

Mathematics subjects are exact subjects that use abstract concepts in solving a problem. Mathematics is said to be abstract due to the use of symbols not found in the real world (Raharjo, 2015). The abstract is the ability to describe or imagine an object. The concept of abstract makes it less desirable for learners, so a real depiction of the material studied is needed (Nurhikmayati et al., 2017). The depiction can be done by describing events that occur around, whether related to social life, culture or economics, in the form of pictures, tables, diagrams, etc.

Mathematics can be connected with culture through ethnomathematics (Setiawan et al., 2021). Ethnomathematics itself is a branch of science that is used as a medium to understand the application of mathematical concepts in culture by looking at the relationship between the two. The role of ethnomathematics as a connecting medium shows that mathematical concepts have been practised and applied to life in society. However, the concept has not been fully realized because the knowledge and ability of learners who are still low in solving problems rely on mathematics. In addition, the results of the PISA (Programme for International Student Assessment) study in 2018 showed that learners in Indonesia, especially in math skills, are still at level 1 (Schleicher, 2018). The level explains that learners are less able to apply mathematical concepts as solution solutions to problems related to real-life contexts. The learning process that has not connected the value of culture and mathematics in people's lives is one of the causes of students' ability to solve the problem is still in the category of lack (Agustina et al., 2019). The cause of the low learning outcomes of learners is that the learning process is done mechanistically by not connecting mathematics to everyday life. Ethnomathematics in the community can be traditional houses, ceremonies, customs, traditional equipment, traditional games, etc.

Traditional games are a series that develop from a certain community habit (Apriyono et al., 2019). Traditional games are generally a means of entertainment for children as a habit. The existence of these games trains children's motor skills such as speed, accuracy, etc. Traditional games contain elements of fun and cultural values that can train skills in thinking and reasoning (Karina et al., 2021). The use of traditional games in the learning process can provide a new learning atmosphere for learners. In addition, learning to be more fun can also be used to preserve local culture. Research related to traditional games has been widely done, one of them Apriyono et al., (2019), which examines traditional games in the learning village of Tanoker Ledokombo Jember, and Febriyanti et al., (2019) researching mathematical

concepts in marble games.

Lampung is one of the provinces in Indonesia located at the southern tip of the island of Sumatra. Some of Lampung culture that is quite widely known include singers, tapis cloth, traditional games, etc. One of the traditional games of Lampung is Arul which comes from the Krui area, West Lampung district. Children often use this game to fill their free time by utilizing coconut shells given a connecting rope. Naming Arul comes from the term Batok shoes, where coconut shells are used as the main material. Previous research has suggested that Arul games contain the concept of circles and half-spheres (Merliza, 2021). There is a difference between the research and the research conducted where previous research is reviewed from the form of Arul footing and has not examined related to the making and regulation of all games. This reason is the basis for researchers to further explore the game Arul Lampung culture. The goal is to determine whether the mathematical concepts in Arul games are expected to be used as a context for making mathematical learning designs in the classroom.



Figure 1. Arul game

METHOD

This study uses this type of exploratory research. Exploratory research is conducted by digging to find and know the concept of a symptom or event by exploring the event (Safitri et al., 2021). The approach used is the ethnographic approach, which is an empirical and theoretical approach that aims to obtain in-depth descriptions and analyses of cultures based on intensive field research. Nuh et al,. (2016) state that ethnographic methods explain and analyze culture in a particular society. This research design uses descriptive research design because researchers tempest the results of observations related to mathematical concepts in Arul games. The instrument used is the researcher himself (human instrument). Data collection techniques are used for observation, interviews, and literature studies to explore

and explore mathematical concepts in Arul games. Observations are made on the object of research as a source of data, namely Arul games. The interview technique used in this study is semistructured. Literature studies are used to collect data needed in research from trusted literature.

The research procedures used according to Spradley (2007) are: (1) determine informants who are qualified for full sanctification, directly involved in cultural objects to be studied, able to explain cultural objects in detail and have enough time for interviews; (2) conduct interviews with informants based on interview ethics i.e., consider the interests of informants first, achieve research objectives, protect informant privacy, and not exploit informants; (3) make ethnographic notes including field records, recording devices, and documentation tools; (4) ask descriptive questions that require explanatory answers; (5) conduct an ethnographic interview analysis by underlining the terms of informants that have been obtained to deepen the research; (6) create a domain analysis by covering what the informant states with a clear semantic relationship; (7) ask structural questions intended to know information in a structured manner from informants; (8) perform taxonomic analysis by focusing on a particular domain so that a problem or phenomenon can be clearly described. This analysis was conducted to create categories of several cultural symbols of the culture studied; (9) writing ethnography provides a narrative explanation of the findings studied.

RESULTS

Based on the research results, it is known that there are several elements of mathematics in traditional Arul games. These elements are division, fraction, comparison, revival and partnership of two circles, the central point, the unit of non-standard length, the hollow half ball, the circle, the odds, the distance, the speed and time. This research focuses on examining several objects, including the process of making Arul, Arul shapes, and Arul game rules. Here are the discussions of the objects that are the focus of the research.

In the process of making, Arul has mathematical elements, namely division, revival and partnership of two circles, determination of the circle's centre point, and units of length are not standard. The element is obtained from the stages carried out in making Arul shells, namely:

First, the element of comparison obtained when choosing coconut shells is usually done incorrectly on one coconut but looking for part of another coconut shell by choosing the same weight and height with the goal of balance when played. An illustration of the comparison element can be seen in Figure 2.



Figure 2. Illustration of comparison of the two coconut shells

Second, the element of revival and the cooperation of two circles is obtained when choosing two coconut shells. The thing to note is to look at the size of the two circles at the bottom of the two shells and must be ensured the same to be comfortable and balanced when used. An illustration of the revival and partnership of the two circles can be seen in Figure 3.



Figure 3. Illustration of the revival and partnership of two circles

Two circles can be a piece because the circle is a flat wake with no angle, so every circle with the other circle is the same. While it is said to be congruent because of the absence of angles in the circle and the selection of coconut shells with the same circle diameter.

Third, the element of determining the centre point of the circle obtained from the coconut shell is selected that is old so that it is strong and not easily broken when played. In addition, it can be selected that already has a hole on it to make it easier to hook the rope with a note of the hole located in the middle of the shell so that the rope can be attached straight and right between the thumb and index finger of the foot. However, it can also be hollowed out on its own. An illustration of the determination of the circle's centre point can be seen in Figure 4.



Figure 4. Determination of the centre point

Fourth, the element of unit length is not standardized in measuring the hook rope adjusted to the height of the player's elbow. If the rope is busted below the height of the elbow, then the player will bend. If the rope is above the elbow, the rope will be longer, making it difficult for the player to keep rolling the rope in his hand. The illustration can be seen in Figure 5.



Figure 5. Illustration of hook strap measurement adjusted to the height of the player's elbow

While based on the form of Arul obtained mathematical elements that are half hollow balls and circles, the description of these elements is:

First, the hollow half ball element is obtained based on the shape of the Arul, where there is no content on the inside of the Arul shell. The illustration of a hollow half ball on the Arul can be seen in Figure 6.



Figure 6. Illustration of a hollow half ball on an Arul Batok

Second, the element of the mathematical circle is obtained from the bottom of the Arul shell in the shape of a circle. The illustration of the circle on the Arul shell can be seen in Figure 7.



Figure 7. Illustration of a circle on an Arul shell

Furthermore, based on the game rules from Arul also has a mathematical element in it. These elements are opportunity, distance, speed and time. The discussion of these elements is as follows.

First, the element of opportunity is obtained from the number and path of Arul players. The relative frequency is obtained from, for example, the player consisting of 3 people. The winner is determined by who first arrives at the finish line with the initial line-line route-end-line-finish-finish line. There are four stages that the player must pass, so the relative frequency of 4 players is 3/9. Furthermore, the sample room is obtained from, for example, 3 players obtained (player 1 line 1; player 1 lane 2; player 1 lane 3; player 2 lanes 1, player 2 lanes 2, player 2 lanes 3, player 3 lanes 1; player 3 lane 2; player 3 lane 3). At the same time, the sample point is obtained from, for example, the sample point of 3 players, namely player 1, player 2, and player 3.

Second is the element of distance, speed and time. The distance element in the Arul game is obtained by paying attention to the player's value in the game, starting from the starting line-end-line-finish line. While the element of speed is obtained from paying attention to how quickly the player completes the existing route. Then time is obtained by paying attention to the length of the player completing the game. The illustration of the element of distance, speed and time can be seen in Figure 8.

8	Player 1
T	Player 2
A	Player3
R	Player 4
Т	Player 5

F I N I S H

Figure 8. Illustration of the speed distance from the time of the Arul game

DISCUSSION

Ethnoomamatics is a branch of mathematics by makes culture a way of doing mathematics in community activities (Lisnani et al., 2020). The activities that occur in society have applied mathematics, and it's just that it has not been fully realized. Therefore, ethnomathematics is present to show and clarify the mathematical elements that exist in the socio-culture of society. The purpose of ethnomathematics is to find out the existence of different alternatives in mathematics, namely by connecting mathematical knowledge developed by various cultural activities of society (Ambrosio, 2008). The scope of ethnomathematics is the analysis of socio-cultural influences in the learning process. The application of ethnomathematics in the learning process is expected to help students in mastering abilities and mathematics and improve their cultural values.

Traditional games are useful as a pleasure and can also improve children's motor skills (Apriyono et al., 2019). Children's motor skills are trained with fun activities, such as counting, making a flat wake, etc. Using traditional games in mathematics learning will make the teaching and learning process more interesting. Arul game is a traditional game of the Lampung tribe, precisely the Krui area, West Lampung. The players of this game are children aged about 10-14 years. The mention of the name Arul comes from the term Batok shoes made of old coconuts. Then, connect with the rope as a handle. The rules of the game are: (1) a referee leads the game; (2) the players involved determine and make the starting line and finish line; (3) the game is played 4 times back and forth to and from the starting point; (4) The player is considered to lose if he falls/suffers a broken rope, and the losing team will get a referee penalty.

Learning mathematics using games will build a pleasant learning atmosphere so that students can better understand the material learned (Merliza, 2021). Through the traditional game of Arul, students are invited to think mathematically without realizing it. Therefore, traditional games can be used as one of the teaching materials for mathematics.

CONCLUSION

Based on the results of data analysis and discussion, it can be concluded that there is ethnomathematics in traditional Arul games. Ethnomathematics found in the process of making Arul is division, fraction, comparison, revival and harmony of two circles. Determination of the circle's centre point and length units is not standard. In the form of Arul obtained ethnomathematics in half hollow balls and circles. While on the game rules, Arul obtained ethnomathematics of opportunity, distance, speed and time. Traditional Arul games are not only for fun but also have mathematical elements in them.

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