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ETHNOMATHEMATIC EXPLORATION BASED ON REALISTIC MATHEMATICS EDUCATION (RME) IN THE TRADITIONAL GAME "LORE"

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Abstrak

Etnomatematika merupakan interaksi antara matematika dan kultur budaya lokal. Penelitian ini bertujuan untuk mengeksplorasi etnomatika pada permainan tradisional "Lore" dalam pembelajaran geometri materi bangun datar. Penelitian ini menggunakan penelitian kualitatif dengan pendekatan etnografi. Subjek penelitian adalah siswa Sekolah Dasar pada materi bangun datar dengan menggunakan permaianan tradisonal "lore". Pengumpulan data dilakukan dengan obeservasi, wawancara dan dokumentasi. Teknik analisis data yaitu dengan cara melakukan observasi lapangan kemudian memberikan pertanyaan terkait apa saja yang dilakukan oleh subjek dengan menggunakan permainan tradisional "lore". Pada pembelajaran geometri materi bangun datar yang abstrak dapat disajikan ke yang lebih konkrit dalam permainan tradisional dan juga dengan adanya *Realistic Mathematics Education* (RME). Hasil penelitian ini menunjukkan adanya etnomatika pada permainan tradisional "lore" dalam pembelajaran geometri khususnya bangun datar (persegi, persegi panjang, trapezium dan lingkaran) berbasis RME. Sehingga dengan keterkaitan tersebut membuat siswa dapat mengetahui bahwa hubungan kultur budaya lokal berbasis RME dan matematika merupakan salah satu kesatuan yang saling berkaitan.

Kata kunci: Bangun Datar; etnomatematika; permainan tradisional lore; *realistic mathematics education* (RME)

Abstract

Ethnomatic is an interaction between mathematics with local culture. This study aims to explore ethnomatic on a traditional game called 'Lore" in-plane figure geometry learning. This is a qualitative study using an ethnography approach. The subjects of this research were elementary students who studied two dimension figure material using a traditional game, Lore. The data were collected through observations, interviews, and documentation. The data analysis technique was by doing field observation and then giving questions related to whatever the subjects did by using the game. On an abstract dimension figure geometry learning could be applied into more concrete in the traditional game and with Realistic Mathematics Education (RME). The findings show an ethnomatic on the conventional game, Lore in geometry learning, especially on plane figure material (square, rectangle, trapezoid, and circle) based on RME. So, the correlation make the students know the relationship between a local culture based on RME and mathematics is an interrelated unit.

***Keywords**: Ethnomatics;plane; realistic mathematics education (RME); traditional game lore*

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INTRODUCTION

Mathematics is one of the of the courses showing rules or pattern in our life. It helps the people on how to solve the problems in a daily life. There are some reasons for people studying or learning mathematics. First is it could improving the brain quality. Second is for chidren who know mathematics, it will make them to be able to recruit specific brain regions more reliably and have a greater volume of gray matter in those regions than those who performed worse in math. Third is mathematics very helps people at home such setting the 2D, 3D dimension, weighing the cooking materials, making the home utilities and playing games for the children with some goods.

Mathematics that has been grown and developed in a certain culture is called ethnomatic (Rohrer & Schubring, 2011). It grows and develops in Indonesia as an alternative to developing mathematics learning tools that have been conventional and less contextual (Abdullah, 2017). Through ethnomatic, the understanding of learning mathematics can be developed into local cultural practices (Cimen, 2014).

From the information above, it can be concluded that ethnomatic means the interaction between mathematics and culture. Cultural-based mathematical learning needs to be explored and studied because this learning includes contextual learning. So far, local culture has not had a place in the mathematics learning curriculum.

One way to create it is by having traditional games. However, classic games/ traditional game that have cultural values and become ancestral heritage must be preserved (Pais, 2011). It is to maintain that culture or local cultures are still known by the generations from time to time.

One of the local cultures is minangkabau culture. One of its is called *Lore*. *Lore* is a game that uses all plane figures in geometry. It uses geometry introduction principles, especially on plane figures in that traditional games. Here, students are asked to know and understand further plane figures that they use in the game. Strategies coming out from the students show the development of students' understanding of situations and problems in the traditional game (Jaelani et al., 2013)

According to (Fitriatien, 2016), the development of mathematics learning sustainably, ethnomathematics, can be used as a reference and a way to bridge mathematics as a science with the socio-cultural of Indonesian people. According to (Aikpitanyi & Eraikhuemen, 2017), most mathematics teachers use ethno-mathematics approach in the learning process.

RME is an action to reform mathematics education in Indonesia. So, it is not only one method of mathematics learning but also an effort to transform social (Sembiring, 2010). The word "real" in "realistic" means meaningful for the students. In RME theory, learning starts from a contextual thing that is real to students' experiences (Gravemeijer, 2006). So, RME is the utilization of reality and environment understood by students to expedite the process of mathematics learning so that mathematics education is better achieved than in the past.

Van Hiele said that there are five thinking steps in learning geometry, i.e., Introduction step, Analysis, Sorting, Deduction, and Accuracy (Cesaria et al., 2021). Based on the thinking steps shown by Van Hiele, it is clear that it

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can be synchronized with RME characteristics (Sembiring et al., 2008). Stepson Van Hiele's theory follows the RME approach. Mathematics learning, especially geometry with RME can be synchronized with cultural context (ethno-mathematics) involving all Indonesian cultures (Palinussa, 2013).

Generally, some studies related to ethnomathematics using the traditional game has been carried out. A research by (Fendrik et al., 2020) analyzing about one of the traditional called *pacu jalur* game. He analyzed about geometry concepts of tube. It shows that the game can be used in mathematics learning by teachers as learning and cultural agents to develop mathematical connection abilities of elementary school students.

Another research (Bunga et al., 2018), They analyzed about Palue tribe and artifact. The research shows that the ethnomatematic forms existing in the Palue society culture include forms of artifacts used in traditional ceremonies, dances, livelihoods, and traditional games. Those social activities are integrated in the mathematics learning in elementary school.

Utami et al. (2018) analyzed about valid, reliable, and effective *Engklek Geometry* learning media. The research used 4-D development model. It shows that students activities are categorized into good category and teacher's ability is included into very good category. So that the media is valid, reliable and effective for students and teachers.

Sukadariyah et al. (2020) also analyzed about *Engklek* game. It is a quasi-experimental quantitative research with a nonequivalent control group design approach. The research shows that a significant influence on the traditional engklek game on children's geometric abilities. The two groups are normally distributed (0.487 > 0.05) and from the homogeneity test, it is found that both groups are homogeneous (0.252 > 0.05).

At last, Mulyasari et al. (2021). also analyzed *Engklek* as the object of the research. It is a literature review research by reviewing several scientific journals. The research shows that the application of the ethnomathematics on the *engklek* game in learning mathematics is effective on students' mathematical problem solving abilities. Based on those previous studies, it can be seen that traditional game could help children, especially elementary school students like mathematics or help them to study mathematics easy way.

However, there is a gap of research based on the previous research. A research using RME has not been found yet during the literature review. This reseach will try to enlight about RME on traditional game of Lore, one of the game from Minanagkabu culture. Then, then it is also focused on geometry on two dimension figure. This object is totally different from others research. Then, this research also combined some techniques for collecting and analyzing data such as observation, interview and documentation.

This research discusses about what are the geometry learning found on the Lore game and then, how is the correlation between It is expected that this reseach could help the elementary school student like to study mathematic, although they are playing game. They could study geometry material fom the game that they play with their friends. At last, the correlation between culture and mathematics (ethnomatematics) could maintain the culture of certain tribes or culture on Indonesia.

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METHOD

This study used qualitative by using an ethnography approach. This study aims to describe cultural characteristics in an individual or group of people who become members of a cultural community. This research was used to understand the theorem that happened to the research subjects, for example, behavior, perception, motivation, and action, by describing them in words and language (Adam, 2010).

The place of this study was Padang city, West Sumatera. The object of this research is the traditional game, Lore, with a source of data were mathematics and students in 3 Elementary Schools in Padang city. Data were collected towards observation, interview, and documentation.

The steps of this research, i.e. (1) Introduction. This step can decide the place and choose the ethnomathematics done by Minangkabaunese ethnic group in West Sumatera. (2) Making guidelines of observation and interview about what the researcher wants to know. Guidelines of observation and interviews did pass any validation step. (3) Doing the research, this step consists of collecting data through observation with ten students who did the traditional game activity, Lore. (4) Data verification verifies the data collected directly from the research, whether from observations or interviews. (5) Data analysis, analyze the result of observations even interviews about geometry, especially on plane figures done by Minangkabaunese elementary students in Padang city. (6) Concluding, from data analysis from activity about plane figures done by Minangkabaunese elementary students in Padang city. (7) Conclusion on this step, a conclusion is taken from data that have been analyzed before. To make it easier to do the research, it needs a research flow like in Figure 1.

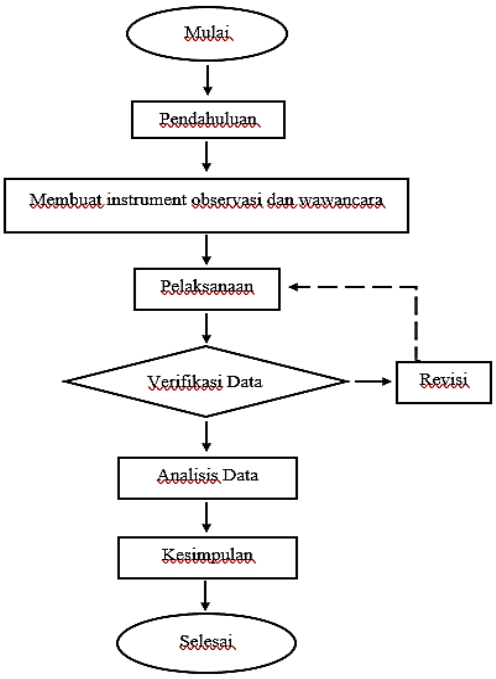

Figure 1. Research Procedure

Before conducting the research, firstly, the researchers had already made appointment with students on a site about playing *Lore* game. The students were coming from local people who are still studying elementary schools. Some of them were in the fourth until the sixt grade. Some of them were male and females.

They were selected based on the purposive sampling. It is because not all of them know about the game and only few of them want to join for the game. Then, they will be divided into groups, so that they could play the game well.

During the game, the researcher conducted some observation about what the students do during playing Lore game. They record the data by using taking picture and put it into document.

They were allowed to make their

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own Lore shapes of Game that they like to play by using chalk. Data of the research were collected during the game played the students. During their break or after they are finished playing the Lore game, the researcher interviewed the students about the two-dimension figure that they have written down on the floor by using chalk. The interview used semi-structure interview by the purpose that the questions can be derived based on the situation and context of the conversation.

For analyzing the data, the researchers combines many sources such as observation checklist/ photo, interview sheet and results and documentation of the photo. At the end of the analysis, the researchers do the triangulation data, by checking all of the information from the photos, interview sheet and other documents for the research.

RESULTS AND DISCUSSION

Development in this age is so fast especially in development of technology. If it is not supported with any knowledge, it will change some traditional games. Basically, traditional games have their own characteristics from where they come from (Supiyati et al., 2019). Therefore, actually in traditional games, there are some elements like child games and society games in the games. These traditional games have a lot advantages and are good for the growth and development of children, whether it is for their physics or mental. Traditional game can train children's left brain so that intellectual and emotional intelligence can run balance.

Traditional game will train every potential of children that can be seen in every children social adaptation behaviors by preserving and love this Indonesian culture all the time. One of the traditional games is from Minangkabau ethnics name Lore. This is a simple game by using marbles as media. The traditional game, lore is one of alternatives that can be used in geometry material especially in plane figure material. This game includes students' ability in making and knowing more characteristics of plane figures well and proper. From making the traditional game, students indirectly have passed the process of knowing of the plane figures characteristics. Some plane figures that can be used in the traditional game is square, rectangle, trapezoid, parallelogram, rhombus, and circle.

Lore is presented in the form of carvings on the ground in the form of a combination of several squares using stonek. *Stonek* is a medium made of flat and flat glass which is then thrown into the squares. Sometimes they use 100, 500, and 1000 rupiah denominations.

Here is the ways of playing Lore

Figure 2. One of Lore game

These are some steps of making the game (Figure 2), lore that has strong relation with geometry steps in making two dimension figures:

1. First step, 2-5 children make squares pattern like a robot (Figure 3), about 30 cm every side of

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square. The gamers usually draw the game in the yard with distance of sole of the root, and limited by chalk or direct scratches to the ground. The games usually create their own pattern that they want to play form several plane figures that they learned in school (Figure 3-5).

Figure 3. Traditional game "Lore" with square

Figure 4. Traditional game "Lore" with circle

Figure 5. Traditional game "Lore" with rectangle and trapezoid

2. Second step, the gamers bring marbles (flat stone) that is used to throw to the square of the game.
3. Third step, started by choosing which gamer will start the game first. The gamers can decide it by doing "hom-pim-pa".

After conducting some observation, there are some points that the researcher find out on Ethnomathematics using RME. They are

1. Learning Mathematics from making picture of Lore. Based on the pictures shown, it can be seen that the students have already known some pictures or two dimension figure of the mathematics such as square, rectangle, and trapezoid. They can say the name of the shape of the picture that they have drawn on the floor.
2. From the gaco/stonek tool. Gaco or stonek is important thing for playing Lore because it will show the place or spot of the player. The are some pictures of mathematics especially two dimension figure on the tool such as round, triangle, rectangle, square and pentagon.
3. From the Lore game participant. Based on the game participant, they will count the number of player from one, two, three, four and five. They will aslo study about the probability in mathematics, which means that they can calculate how many times that they involve of join into the game.
4. From the rules of the Lore game.

It is normal that every game will have set rules. In Lore game, they must know how to step by using one foot or two feets together on the game. If they make a mistake they will be replaced by another participant. So the students learn about sequence of the number and logics and problem solving of mathematics.

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In addition, based on the interview from all of the students involving on the Lore game, it shows some advantages about the game from the culture point of views.

1. The student physical ability becomes stronger because they must jump during palying the game.
2. The game could build their social relationship with others.
3. The game could develop the student's logic. It is because they have to calculate and set the steps to pass.
4. The students are more creative. They make the goods based on the things that they see from the surroundings. It makes them more creative to create the game tools in many shapes.
5. The game is good for their mental health. It can communicate their own feeling effectively by natural ways. They are also lack of stress. They can control their mind and become more concentration.

In relation Ethnomathematics point of views, there are some benefits of playing game. Based on the steps of the traditional game "Lore" that have been explained above, it can be seen that making the game made could facilitate the students to be more creative in making shapes of geometry especially on plane figures. On the other hand, students could also train their abilities to understand characteristics of the planes. Concept of Geometry form the traditional game "Lore" are shown in Table 2.

Many studies have already explored culture or traditional games in mathematics learning (Nur et al., 2015) (Palhares, 2012) (Risdiyanti & Prahmana, 2018). The results of the studies state that learning mathematics with a cultural basis can improve students' learning abilities (Sukadari et al., 2015). One of them is in the traditional game "Lore". Students are able to understand the geometry material in the concept of two dimentiona figure. By describing the shape of "Lore" students can understand the elements for each of the shape. Students, who experience or describe the form of the game "Lore", will immediately feel its implementation in their daily life (Fauzan, 2002).

Table 2. Concept of Geometry form the traditional game "Lore"

No.	Shape of Plane Figures	Concepts in Traditional Game "Lore"
1.	Square	Students understood that square is made from four equal length sides, and parallel sides
2.	Rectangle	Students understood that rectangle has four sides, two pairs are parallel and the same length
3.	Trapezoid	Students understood that trapezoid is formed parallel rectangles.
4.	Circle	Students understood that circle has nets and diameter.

Mathematical problems in everyday life can be solved with the concept of mathematical knowledge (Verner et al., 2019). This mathematical problem with Realistic Mathematics Education can improve students' cognitive abilities (Laurens et al., 2018). According to (Irawan & Kencanawaty, 2017) learning mathematics by linking it to problems with everyday life and the surrounding culture can improve student learning outcomes. Therefore, the traditional game "Lore" can provide students with an understanding of the material of two dimension figure.

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Some contributions are also found on the Lore game where it is not only as an entertainment game, but it applied as a medium learning in learning mathematics because in the game contains many elements dispensable math to students. So, by applying Lore traditional games will make students interested and motivated in learning mathematics.

Application of ethnomathematics in learning activities very important because with the application of that students will understand and love the culture surrounding. So, it is expected many researchers do research related to traditional games or other culture to make as a learning medium or student learning resources.

CONCLUSION AND SUGGESTION

Based on data analysis and discussions, it can be concluded that there was an exploration of Ethno-mathematics based on Realistic Mathematics Education (RME) in traditional game "Lore". The ethno-mathematics in the traditional game "Lore" appeared on concepts of characteristics on plane figures. Understanding plane figures material with the traditional game "Lore" can be applied directly into daily life. Understanding the geometry material through the traditional game "Lore" could be seen directly into social cultural life in Minangkabaunese West Sumatera province. On the other hand, from the exploration on ethno-mathematics in geometry learning through the traditional game "Lore" based on RME could give an understanding to parents and teachers in school about how important the ethno-mathematics approach in the traditional game to bridge between mathematics material in school with social cultural life of children in Minangkabaunese place West Sumatera Province.

Based on this study about ethno-mathematics in the traditional game "Lore", so it is suggested that to conduct an ethno-mathematics research on other traditional games. It is hoped that the findings in this ethno-mathematics study can be used as materials to develop mathematics teaching material.

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