

EXPLORATION ETHNOMATHEMATICS OF THE GENDANG HOUSE NAWANG PAJO WEST MANGGARAI

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ABSTRACT

This study aims to explore mathematical concepts contained in the Nawang Pajo Gendang house in West Manggarai which can be used as a medium for learning mathematics, especially geometry. This research is qualitative descriptive research with an ethnographic approach. Based on the results of observations, several mathematical concepts were obtained in the House of Gendang Nawang Pajo West Manggarai. The results showed that the parts of the Nawang Pajo Gendang house in West Manggarai related to mathematical concepts include carvings on the end of the rooftop of the Gendang house, the rooftop of the Gendang house, and the model and shape of the Gendang house are closely related to the concept of Geometry including building flat and building space and transforming geometry including dilatation and reflection.

Keywords: Ethnomathematics, Gendang House, Ethnography.

1. Introduction

Education is a basic human need as a group of people who have knowledge, skills and customs that are passed down from generation to generation through an education, training and research. Education is not in an empty space. Education is formed and based on the context of the society and culture in which it is located. Education is practically inseparable from cultural values. In maintaining and preserving one's own culture, the process of transferring it is most effective by means of education. Education and culture are closely related because they complement and support each other. Education emphasizes more in terms of practice, which concerns learning activities (Ahmadi & N., 2001), this cannot be separated, because the two are closely related in strengthening the improvement of quality and learning objectives (Elok Faiqotul Himmah. 2021).

Initially mathematics was developed by humans using it in everyday life, but eventually mathematics began to be developed and began to

be studied in schools (Barton, 1996; Safitri, 2015; Aikpitanyi and Eraikhuemen, 2017) (Muliani et al. 2020), the development of mathematical science is closely related to human cultural life. According to Aikpitanyi and Eraikhuemen (2017) (Muliani et al. 2020), revealing a cultural approach is proven to be a learning strategy to improve student learning outcomes. According to Paning di Abdurrahman in 2003. 252 (Rosita 2019), mathematics is a way to obtain information using experience on how to calculate, especially the shapes and measures that science uses to see and use relationships between people. With the learning of mathematics in each educational unit, it is hoped that each student will acquire the skills and abilities of each student and will be able to solve mathematical problems in everyday life. The success of the learning process is a very important thing needed by an institution to maximize learning success.

But in reality, mathematics learning does not go with what is expected. Mathematics learning is considered a difficult subject by some students, parents and the general public (Asterius Juano and Maria J . 2019). The existence of this understanding greatly reduces the results of learning mathematics. In fact, without realizing it, students, parents and society are always connected

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to mathematics in their lives unknowingly. This is because mathematics learning does not connect mathematics with student culture. Cultural context learning is used to foster students' desire to learn because it is easy to remember, because the student is directly involved in learning and is directly related to the student's life (Eti Rohaeti, 2011) (Rakhmawati 2016).

According to Wahyuni, et al (2013) (Rahmawati Z and Muchlian 2019) revealed that ethnomathematics is a method that can link culture with education in mathematics, because people have not realized that the activities they do have mathematical ideas and knowledge of mathematics.

Ethnomathematics according to D'Ambrosio is a study that investigates the ways in which society understands, articulates, and applies mathematical practices and concepts (Rosa and Orey, 2011). According to Bishop, ethnomathematics is called ethnomathematics, which is where teachers and students appreciate the culture and culture with regard to the curriculum (Barta and Shockey, 2006) (Sely 2019). The characteristics of mathematics of an abstract nature cause students to lack interest and even fear to study mathematical science. Therefore, ethnomathematics is very necessary in increasing student knowledge and with an ethnomathematics approach students can get to know abstract mathematical concepts into real (real) for example by relating mathematical concepts to objects around students that resemble mathematical shapes and concepts, thus students do not easily forget the material they are studying. In previous research, there were several studies that examined mathematical elements contained in traditional houses in Indonesia. The research conducted by (Rahmawati Z and Muchlian 2019) with the research title "Ethnomathematic Exploration of The Minangkabau Gadang House of West Sumatra".

The Gendang house is in the form of a pentagonal cone which consists of three main parts, namely: Kolong (Ngaung) which is the bottom of the house, Residence (Bate Kaeng) which is a human residence and roof (wuwung) which is the roof of a house with three logos, namely sacrificial pots, buffalo horns and ijuk roof (Melita M. Muliani, et al: 2020).

This study aims to explore mathematical concepts contained in the Gendang house (traditional house) in Manggarai, especially the Gendang House of the Nawang tribe in Pajo

village, West Manggarai to provide an understanding to students and the community that around social life there are elements of mathematics and have recognized them before being studied at school.

2. Research Methods

The research method used in this study is descriptive qualitative with an ethnographic approach that aims to explain the concepts contained in the Manggarai Gendang of house. According to Duranti (Kamarusdiana 2019) ethnography is a written picture that is about the characteristics of the social life of a community of people, including social organizations, social activities, symbols, physical resources, and the practice of interpretation of certain groups of people. Ethnography aims to explain and analyze culture based on intensive fieldwork research. Ethnographical studies in this study were used to introduce culture through mathematical presentations at the Manggarai Gendang of house. There are several steps of ethnographic research proposed by Spradley (1997) in ethnographic books are as follows: (a). establish informants, (b). conduct interviews, (c). make ethnographic notes, (d). ask descriptive questions, (e). conduct ethnographic interview analysis, (f) make domain and taxonomic analysis, (g). ask structural questions and contrast questions, (h). make component analysis, (i). find cultural themes and (j). writing ethnography. This research was held in Pajo village, Raka village, Ndosso district, West Manggarai regency, East Nusa Tenggara. The subjects in this study are research themselves and traditional figures (Tu'a Gendang, Tu'a Golo and Tu'a Teno), as well as manggarai community stores. The data collection methods used in this study were observation, interviews and documentation. The data analysis methods used are data reduction, triangulation, data presentation and drawing conclusions. According to Sely 2019), in his research the stages of data analysis used in a study are as follows: (a). Data Reduction, (b). Triangulation, (c). Presentation of Data and (d). Drawing Conclusions. According to Noeng Muhadjir (1998: 104) explained the meaning of data analysis as an effort to systematically search

and organize records of observations, interviews, and others to improve research understanding of the cases studied and present them as findings for others (Rijali 2019).

3. Results and Discussion

The research area chosen was Pajo village, Raka Village, located in Ndoso District, West Manggarai Regency. Raka village has a long distance from the district town center. The majority of the people of Pajo village in Raka village make a living as farmers. Pajo Village is one of the villages of the indigenous Nawang tribe. The Nawang tribe is an indigenous tribe of Pajo village that always preserves and upholds local traditions and culture.

In Pajo village, there are many community leaders whose daily lives are still thick with culture and still uphold the traditions used by the ancestors. At every event carried out the community is always compact and participates in the ceremonies carried out. One of the cohesiveness that is carried out is that every time there is an event, the people of Pajo village always use Manggarai traditional clothes and traditional houses (*mbaru Gendang*) during the event. In this study, the focus of the research is the *mbaru Gendang* or Manggarai traditional house which is used by the Manggarai community as a place for traditional ceremonies and as a place to carry out deliberations.

Mbaru Gendang Manggarai is the center and center of cultural preservation. *Mbaru Gendang* is also a place where all cultural implementation processes are carried out. *Mbaru Gendang* Nawang Pajo is located in the middle of Pajo village, the height of *mbaru Gendang* is about 15 m, the roof of *mbaru Gendang* there is an image of a human face which is interpreted as a tribal chief or village head flanked by buffalo horns, which is a symbol of the hard work of the Manggarai people. The traditional house of Pajo village has mathematical concepts that can be used as teaching materials in schools. The roof of the *mbaru Gendang* is in the form of a 9-Faceted Pyramid, the main pillar is tubular whose height is 3 cm, the shape of the roof easel in the *mbaru Drum* is in the form of a geometric transformation of the dilatation and outside the *mbaru Drum* there is a *tatter* in the shape of a circle.

Table 1. Ethnomathematics at the house of Gendang Nawang Pajo

Ethnomathematics	Implementation
Roof House of Gendang Nawang Pajo. 	The roof of The Nawang Pajo Gendang of house is covered with a 9-faceted pyramid. Limas is a facet many (pedestals) and several triangles that meet at one apex. Because of the roof mat. The House of Gendang Nawang Pajo facet 9 is then called Limas because it has the shape of the n-faceted base with an upright side is triangular in shape.
Compang 	The <i>Compang</i> resembles a circle. A circle is the position of points that are equidistant to one specific point. The elements of the circle include: having 1 central point (O) right in the middle of the circle, having no angular point, the number of corners of the circle is 360^0 , has 1 side in the form of a closed curved line.
Main pillar of the Pajo Gendang of house. 	The main pillar of the Pajo Gendang of house resembles a tube. The tube is a construct space that has three 3 main side planes namely the base side plane and the upper side plane which is shaped by a congruent and parallel circle and an arch plane called a tube blanket.

Horses of the inner house.	The horses of the inner house Of the drum resemble the transfo- mation of geometry (dilation). Dilation is a transformation that resizes (decreases/enlarges) a wake but does not change the shape of the wake.
Shape of the roof terrace.	The shape of the roof of the terrace of the Gendang of house is a pentagonal pyramid. A pentagonal pyramid is a type of pyramid that has the shape of a pentagonal flat base, both regular and irregular pentagons. The characteristics of the pentagonal pyramid are: it has 6 sides, has 10 ribs, has 6 corner points.
Roof terrace of House.	The roof mat of the terrace of the Gendang house resembles a 5-faceted flat build. A pentagon is a wake that has as many as five sides called a pentagon build. The pentagon has properties, namely: it consists of five side fruits, there are five axes of symmetry, have five angular points, the magnitude of all the angles on the pentagon amounts to 450 degrees.
Rangga Kaba	The Rangga Kaba contained in the motifs/carvings of the Drum house resemble reflections. Reflectio

	n is a transformation that moves a point in a geometric build by using the properties of an object and its image on a flat mirror. The characteristics of reflection are that the object being flexed does not undergo changes in shape and size and the distance of the object with the mirror is equal to the distance of the mirror image.
Tambor 	Drum tambor musical instrument resembles a tube. The tube is a construct space that has three 3 main side planes namely the base side plane and the upper side plane which is shaped by a congruent and parallel circle and an arch plane called a tube blanket. The surface area of the tube is: $L = \pi r t + 2\pi r^2$. With r = radius of the tube and t = height. While the volume of the tube can be calculated using the formula: $V = \pi r^2 t$.
Gong's 	Gong's musig tool resembles a circle. A circle is the position of points that are equidistant to one specific point. The elements of the circle include: having 1 central point (O) right in the middle of the circle, having no angular point, the number of corners of the circle is 360^0 , has 1 side in the form of a

	closed curved line. The area of a circle is calculated by the formula $\pi \times r^2$, Calculate the circumference of a circle using the formula $2 \times \pi \times r$, radius with formula $\frac{d}{2}$, the diameter of the circle is calculated using the formula $2 \times r$.
 Gendang	The Gendang musical instrument resembles a Tube. The tube is a construct space that has three 3 main side planes namely the base side plane and the upper side plane which is shaped by a congruent and parallel circle and an arch plane called a tube blanket. The surface area of the tube is: $L = \pi r t + 2\pi r^2$. With r = radius of the tube and t = height. While the volume of the tube can be calculated using the formula: $V = \pi r^2 t$
Roof Handler 	The roof handler is a right triangle, because it is triangular in shape and one of the corners is right.' A right triangle is a flat wake of a triangle whose one of the angles has a degree which is right-angled and perpendicular. The properties of a right triangle are: It has two sides that form an elbow where both sides hold an angle

	perpendicular to it and It has a hypotenuse section on a right triangle located opposite the right angle
Door Gendang House 	The door of the Gendang house resembles a square. A square is a two-dimensional plane shape formed by four sides. Pesegi has 4 axes of symmetry and 4 symmetries of rotation, has 4 equally long sides, parallel opposite sides and the same diagonal length. Here is the formula for the area and circumference of a square: $L = s \times s$ $L = 4 \times s$
Door Gendang House 	The door of The Gendang house is rectangular. A rectangle is a two-dimensional flat construct consisting of two pairs of sides each of which is the same length and parallel. Properties of a rectangle: opposite sides equal in length, it has four corners, all of which are right angles (90°). the diagonals are the same length and visit two equal lengths. Here is the formula for the area and circumference of a rectangle: $L = p \times l$ $K = 2 \times (p + l)$

House Walls 	The walls of the house are rectangular. A rectangle is a two-dimensional flat construct consisting of two pairs of sides each of which is the same length and parallel. Properties of a rectangle: Opposite sides equal in length, It has four corners, all of which are right angles (90°). The diagonals are the same length and visit two equal lengths. Here is the formula for the area and circumference of a rectangle: $L = p \times l$ $K = 2 \times (p + l)$
Windows 	The windows of the Gendang house are rectangular. A rectangle is a two-dimensional flat construct consisting of two pairs of sides each of which is the same length and parallel. Properties of a rectangle: opposite sides equal in length, It has four corners, all of which are right angles (90°). The diagonals are the same length and visit two equal lengths. Here is the formula for the area and circumference of a rectangle: $L = p \times l$ $K = 2 \times (p + l)$
Base Pole Gendang House	 rectangular. A rectangle is a two-dimensional flat construct consisting of two pairs of sides each of which is the same length and parallel. Properties of a rectangle: opposite sides equal in length, it has four corners, all of which are right angles (90°), the diagonals are the same length and visit two equal lengths. Here is the formula for the area and circumference of a rectangle: $L = p \times l$ $K = 2 \times (p + l)$  The base pole of the Gendang house resembles a square. A square is a two-dimensional plane shape formed by four sides. Square has 4 axes of symmetry and 4 symmetries of rotation, has 4 equally long sides, parallel opposite sides and the same diagonal length. Here is the formula for the area and circumference of a square: $L = s \times s$ $K = 4 \times s$

There are still many objects in the Nawang Pajo Gendang house that can be integrated with mathematical concepts. Mathematics learning that is integrated with culture has positive values for the preservation of the nation's culture and students' mathematical abilities. Ethnomathematics learning by incorporating local wisdom in mathematics learning can help students to better understand mathematical concepts contextually through cultural results in an area, and that way

teachers can instill the noble values of the nation's culture so that it has an impact on character education.

Cultural results in mathematics learning are only as a preliminary introduction to understanding mathematical concepts. The subsequent analysis process requires the role of information technology. So that it is appropriate, ethnomathematics to be used as one of the current methods of learning mathematics, in addition to strengthening the identity and character of the Indonesian nation.

4. Conclusions

Exploration at the House of Gendang Nawang Pajo Manggarai found various mathematical concepts that can be taught in schools such as: geometry (build flat and build space) and geometric transformations (dilatation and reflection / mirroring).

The meaning of the Gendang of house for the Manggarai community is as a place where traditional methods take place. The motif /carving found in the Gendang of house of the Nawang Pajo tribe is an image of a human face fired by buffalo horns tied by rattan ropes. The human face is defined as a landlord or leader who leads the people of Pajo village in daily life and the buffalo horn is a symbol of the hard work of the community.

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