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MATHEMATICAL CONCEPTS AND CULTUR VALUES IN SONAF TAMKESI: ETHNOMATHEMATICS STUDY IN A TRADITIONAL VILLAGE ON TIMOR ISLAND

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Abstract

Mathematics is a universal science, and it is crucial for everyone to master it, both in terms of its applications and its cognitive patterns. The purpose of this research is to explore the concepts of mathematics and cultural values found in the artifacts of *Sonaf Tamkesi Manufui*. The study was conducted in the traditional village of Tamkesi, south Biboki District, North Central Timor Regency, in July 2023. The subjects of this study were three community leaders. The type of data collected for this research was primary data obtained through documentation and interviews between the researcher and the respondents. Data analysis was conducted through stages of domain analysis, taxonomy, componential analysis, and cultural themes. The research findings indicate that there are concepts of plane geometry in the artifacts such as trapeziums, rectangles, squares, rhombuses, triangles, circles, cylinders, hexagons, and cubes. Meanwhile, the cultural values of the artifacts in *Sonaf Tamkesi* are the roof symbolizes harmony, the door symbolizes greatness and respect for ancestors, the pillars symbolize vertical relations with ancestors, the betel-nut container symbolizes service, the clay pot symbolizes a gift from ancestors to the living, the hearth symbolizes balance, and harmony in achieving goals.

Keywords: Culture values, Ethnomathematics, Mathematical concept, Sonaf Tamkesi, Traditional village.

Abstrak

Matematika merupakan ilmu pengetahuan yang universal, dan sangat penting dikuasai oleh setiap orang, baik terkait dengan penerapannya maupun dengan pola pikirnya. Tujuan dari penelitian ini adalah untuk mengeksplorasi konsep matematika dan nilai budaya yang terdapat pada artefak Sonaf Tamkesi Manufui. Penelitian ini dilaksanakan di kampung adat Tamkesi, Kecamatan Biboki Selatan, Kabupaten Timor Tengah Utara pada bulan Juli 2023. Subjek dalam penelitian ini adalah 3 orang tokoh masyarakat. Jenis data dalam penelitian ini adalah data primer, yang diperoleh melalui dokumentasi, dan wawancara antara peneliti dan responden. Analisis data dilakukan melalui tahapan analisis domain, taksonomi, kompenensial, dan tema kultural. Hasil penelitian menunjukkan bahwa terdapat konsep matematika bangun datar seperti trapeium, persegi panjang, persegi, belah ketupat, segitiga, lingkaran, tabung, segienam, dan kubus. Sedangkan makna simbolik dari artefak yang ada di Sonaf Tamkesi yaitu atap melambangkan keharmonisan, pintu melambangkan kebesaran dan wujud penghormatan terhadap para leluhur, tiang melambangkan relasi vertikal dengan para leluhur, tempat sirih melambangkan pelayanan, periuk tanah melambangkan suatu karunia dari leluhur kepada manusia yang masih hidup. tungku melambangkan keseimbangan, dan keharmonisan dalam mencapai tujuan.

Kata Kunci: *Etnomatematika, Kampung Adat, Konsep Matematika, Nilai Budaya, Sonaf Tamkesi*.

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INTRODUCTION

Mathematics and culture are two things that are closely related to each other. The field of study that connects the world of mathematics and culture is ethnomathematics. Ethnomathematics as the special methods used by certain groups of people in carrying out their activities such as grouping, sorting, calculating and measuring activities (Machaba & Dhlamini, 2021; Umbara et al., 2021). Mathematics applied by certain cultural groups, groups of workers/farmers, children from certain classes of society, professional classes, and so on. According to Djara et al. (2021) that ethnomathematics is a link between mathematics and culture so that it can study every element of mathematics that exists in a particular area. Ethnomathematics can be defined as mathematics in the surrounding environment or mathematics in society (Auw et al., 2024). The culture referred to depends on certain groups of people who are unique. It is called unique because the culture attached to this community group is based on habits that have been passed down from generation to generation.

To understand mathematical concepts in a culture, it is necessary to carry out an exploratory study. Exploration is a method used by someone to discover new things through observation or experimentation in everyday life. There are several opinions that define exploration, including according to Al-Mahdi (2020), exploration is the process of exploring to look for new possibilities with the aim of gaining more knowledge. Exploration activities are exploring the field and with the aim of gaining more knowledge, especially of the natural resources found in that place (Heldanita, 2019).

One of the traditional architectural buildings owned by certain communities is a traditional house. Traditional houses are traditional buildings owned by certain tribes which have been passed down from their ancestors from generation to generation. A traditional house is also a place of protection and implementation of customs, as well as a place to store ancient objects left by ancestors. According to Lede and Dapa (2021) the purpose of a traditional house is as a place to store all sacred items, including humans who live in a traditional house to carry out traditional activities and other activities. In this case, the traditional house of a tribe symbolizes a culture. Traditional houses which have characteristics and are used as residences, storage places, and as venues for traditional ceremonies (Auw et al., 2024). Traditional houses are a form of cultural representation of a cultural group of people in a particular area. Until now, there

are still many tribes or regions in Indonesia that still maintain traditional houses as an effort to maintain cultural values so that they are not displaced by modernization culture.

A traditional house is a building that has special characteristics and is used as a residence by a particular ethnic group. Traditional houses are also used as places where traditional ceremonies are held. North Central Timor Regency is one of the regencies in East Nusa Tenggara Province which has a variety of regional cultures which have distinctive characteristics that make them slightly different from other areas. Apart from that, there is something interesting about the culture in North Central Timor, namely the trapezoid-shaped traditional house. The construction of the *Sonaf Tamkesi* traditional house is still traditional, namely using materials from nature. The construction did not use nails but instead used ropes from Palmyra tree.

Tamkesi is an attractive part of the village in a valley directly facing Mount Sonmahole and next to it the beautiful Taitoh Hill. The Biboki people call this place a lopo, meaning a barn for solving problems. In this place the king and the leaders of the Biboki kingdom considered the problems faced by the Biboki people every day as well as problems related to the kingdom.

The *Sonaf Tamkesi* traditional house is very unique, and has the potential to contain mathematical concepts. Apart from that, it has shapes and artifacts that have been preserved to this day. Of course, these artifacts are still maintained because they contain cultural values. Therefore, this research was carried out to explore mathematical concepts and cultural values found in the *Sonaf Tamkesi* traditional house.

RESEARCH METHODS

This type of research is qualitative research with an ethnographic approach. This research was carried out in Tamkesi Traditional Village, Biboki Selatan District, North Central Timor Regency in July 2023. The subjects in this research are people who can provide explanatory information about something to be researched. The subjects in question include traditional elders (1 person), guardians of *Sonaf Tamkesi* (1 person), and the community in *Sonaf Tamkesi* (3 people). The type of data for this research is primary data.

The research procedure uses three stages, namely the preparation stage, implementation stage, and data processing stage. In this preparation stage, the researcher designed a research instrument in the form of an interview guide, and made initial observations at the research location to ensure that there were potential mathematical concepts that could be explored. At the implementation stage, researchers conducted interviews, observations and documentation. These three instruments support each other to collect data about mathematical concepts and culture values found in the *Sonaf Tamkesi* traditional house. Meanwhile, at the data processing stage, researchers analyze and evaluate the data that has been collected.

The data analysis technique according to Spradley (2016) consists of four stages: domain analysis, taxonomic analysis, componential analysis, and cultural themes. The domain analysis stage is conducted to obtain an overall picture of the situation of the researched object, the obtained picture is not yet in-depth. The taxonomic analysis stage is carried out to determine the research focus, and the researcher will deepen the data collection process. The data collection process can be continuous through observation, interviews, and documentation until the researcher obtains more data. Meanwhile, in the componential analysis stage, the researcher breaks down the established domain into the research focus, and the researcher begins to search for similar elements through focused interviews, observations, and documentation. Cultural themes are analyzed to find common threads so that the researcher can link the mathematical concepts and cultural values found in the research object.

RESULTS AND DISCUSSION

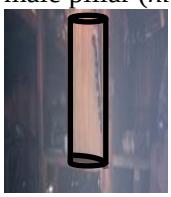
In this section, the results and discussion will be described based on the objectives of this study, namely mathematical concepts and cultural values in the *Sonaf Tamksesi* traditional house.

Mathematical concept of the *Sonaf Tamkesi*

Based on the results of documentation analysis and interviews with the respondents of this research, a number of data were obtained which can be analyzed through the stages of domain analysis, taxonomic analysis, componential analysis and cultural theme

analysis. A summary of mathematical concepts from the results of this analysis can be summarized in Table 1.

Table 1. A summary of mathematical concepts of the *Sonaf Tamkesi*

Part of *Sonaf*:	Roof	Foundation	Door surface
Picture:			
Math concept:	Trapezium	Circle	Rectangle
Part of *Sonaf*:	Female (*ni bife*) and male pillar (*ni atone*)	Place of betel-nut	Place of betel-nut
Picture:			
Math concept:	Tube	Cuboids	Rhombus
Part of *Sonaf*:	Place of betel-nut	Place of betel-nut	Place of betel-nut
Picture:			
Math concept:	Square	Rectangle	Reflection
Part of *Sonaf*:	Basket	Clay pot	Flat basket
Picture:			
Math concept:	Tube	Circle	Hexagon

Trapezium

The trapezoid shape found in traditional house roofs is called a trapezoid because it is a flat shape that has four sides and corners that face each other. This is in accordance with the definition of a trapezoid according to Tas'au et al. (2023) that trapezoid is a quadrilateral that has exactly one pair of opposite and parallel sides.

Circle

The circular shape is found in the basic shape of the foundation, the basket and nyiru are circular in other words a curved line that rotates without end or infinity. Meanwhile, the

circular process is shaped because in the weaving process each shape is a basket with a diameter of 40 cm and a nyiru measuring approximately 20 cm. In traditional houses, an earthen pot is called a circle because it has a circular center point at the foundation and the earthen pot forms a circle. This is in accordance with the definition of a circle, it is the position of points that are the same distance from a certain point, namely the center point on a flat plane (Juano et al., 2019).

Square

The Square is found on traditional house doors. A door is called a square because it has four equal corners and the angles are the same size. This is in accordance with the definition of a square according to Tahu et al. (2023) that square is a rectangular flat shape that has four sides of the same length and has four right angles of 90 degrees and has four axes of folding and rotating symmetry.

Rectangle

The rectangular shape is found in the shape of walls, doors and other betel-nut containers. If a line is drawn on each side, it will have the shape of a rectangle. It can be said to be a rectangle because both sides are the same length, parallel and have four right angles. This is in accordance with the definition of a rectangle according to Sujatmiko (2005), a rectangle is a rectangular flat shape that has two pairs of parallel sides of the same length and has four right angles.

Haxagon

Based on the results of the interview, it was found that the hexagon shape of the nyiru is a hexagon, which if lines are drawn on each side of the nyiru will form a hexagon.

Tube

The shape of the tube on the main pole. This is based on the formation of two circles that are similar and parallel and have a rectangle surrounding the two circles. This is in accordance with the definition of a tube according to Djara et al. (2021), a tube is a geometric shape in the form of a regular upright prism with a circular base. A geometric figure bounded by two parallel circles is a cylinder.

Cuboids

The betel-nut is called a block because it is a combination of two betel containers, the cover and the main betel container, because it has four equal sides. This is in accordance with the definition of a cuboid according to Manasikana (2023), a cuboid is a geometric shape that has six square sides of the same size.

Rhombus

The rhombus shape in the image in the betel location is in the shape of a rhombus because it has four sides of the same length and the angles opposite each other have the same size. This is in accordance with the definition of a rhombus according to Sujatmiko (2005) which states that a rhombus is a rectangular flat shape formed from an isosceles triangle and its reflection after being reflected from its base and has two angles that are side by side 180 degrees and have sides that face each othernot perpendicular.

Apart from the concept of flat building and building space, the concept of counting and the concept of distance are explored from the *Sonaf Tamkesi* traditional house. The concept of counting is seen in the traditional *Sonaf Tamkesi* house building. It can be seen from the arrangement of the wood on the roof of the house. Before the construction process, indigenous tribal people calculate or determine the amount of wood or poles that will be used. Counting is an activity related to the question "how many" of an object or tool which is often used by stating natural numbers starting from one until all objects are counted (Budiarto et al., 2022; Kehi et al., 2022). Meanwhile, the concept of distance is seen in the way each piece of wood or pole is placed or arranged in a traditional house building, because to place one object next to another, you definitely use the concept of distance by measuring.

Based on research results, the concept of reflection in betel places has an element of reflection. This can be shown from its shape, if an axis of symmetry is created so that it cuts the betel nut into two parts, right and left, the axis of symmetry is the line that divides a shape on one side and will be the same as the mirror image on the other side. Reflection is a displacement or shift of all points on an object or shape towards a line at the same distance. According to Yanti and Haji (2019) that reflection is a reflection that produces a shadow by moving each point on a plane, by distance between the image and the original difference to the mirror are the same, as well as their size and shape also the same.

Culture values of the *Sonaf Tamkesi*

Based on the results of documentation analysis and interviews with the respondents of this research, a number of data were obtained which can be analyzed through the stages of domain analysis, taxonomic analysis, componential analysis and cultural theme analysis. A summary of the cultural values obtained from the results of this analysis can be summarized in Table 2.

Table 2. A summary of culture values of the *Sonaf Tamkesi*

Part of *Sonaf Tamkesi*	Culture values
Roof	Harmony and greatness
Door Surface	Greatness and respect for ancestors
Female and male pillar	Vertical relationships with ancestors
Clay pot	Service
Place of Betel-nut	A gift from ancestors to the living
Furnace	Balance, and harmony in achieving goals

The culture values in Table 2 are the result of a synthesis of a number of artifacts in the *Sonaf Tamkesi* traditional house, including the trapezoidal roof itself so that rainwater cannot enter the house and the wind does not easily tear down the roof. The roof itself is trapezoidal in shape, as stated by Baharuddin et al. (2023), serving the purpose of preventing rainwater from entering the house and making it less susceptible to being blown off by the wind. The doors in the *Sonaf Tamkesi* traditional house are made as low as possible with a size of one square meter. This low door suggests a bowing posture when leaving or entering a traditional house as a form of respect for the ancestors who are believed to inhabit the house in spirit (Hermansyah, 2017). The main pillar functions as a place to surrender and convey requests to the supreme being through the ancestors. In terms of the middle pole, it symbolizes the connection between humans and the highest party (Fouk et al., 2019). One of the traditions of the people of the tribe is serving betel-nut to any guests or members of the extended family of the tribe. The betel-nut place is meaningful as a means of social interaction, social approach, social kinship. Clay pot is called the biboki tribe as *oe manikin* (blessed water). *Oe manikin* symbolizes a good gift from the ancestors to the surviving members (Sianipar et al., 2015). Another artifact in the form of plat basket in the *Sonaf Tamkesi* traditional house is used to winnow/clean rice and corn, while pone is used as a place to store food. The stove in the *Sonaf Tamkesi* traditional house is used as a fire place for

cooking rice, boiling corn and cooking meat offerings for the ancestors. The furnace (see Figure 1) symbolizes balance, equality and harmonization in achieving goals (Kehi et al., 2022).

Figure 1. The furnace in the Sonaf Tamkesi

CONCLUSION

Mathematical concepts found in the *Sonaf Tamkesi* traditional house are the concept of plane geometry, the concept of counting, and the concept of distance. The concepts of geometry are trapeziums, rectangles, squares, rhombuses, triangles, circles, cylinders, hexagons, and cubes. There are other concepts is reflection.

Meanwhile, the cultural values of the artifacts in Sonaf Tamkesi are the roof symbolizes harmony, the door symbolizes greatness and respect for ancestors, the pillars symbolize vertical relations with ancestors, the betel-nut container symbolizes service, the clay pot symbolizes a gift from ancestors to the living, the hearth symbolizes balance, and harmony in achieving goals.

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