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SPATIAL GEOMETRY IN THE TRADITIONAL ARCHITECTURE OF EAST TIMOR: "CASE STUDY OF THE SAMALARI-DIRMAN SACRED HOUSE, BURUMA VILLAGE, BAUCAU MUNICIPALITY"

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A R T I C L E I N F O

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A B S T R A C T

The purpose of this research is to explore the culture of the Samalari-Dirman Traditional House, Buruma village, Baucau municipality, and describe the mathematical concepts that exist in the building elements of the Traditional House. This research is descriptive qualitative research with an ethnographic approach. The results of this study indicate that the building elements such as poles, doors, and roofs of the Traditional House contain the concept of geometry of building a space that can be implemented as mathematics learning materials such as Flat Buildings, Build a Space, Concept of Line, Geometry transformation (reflection, dilation).

INTRODUCTION

Geometry is a branch of science that studies the relationship between points, lines, and planes as well as flat and spatial shapes. In the application of geometry math is very helpful in everyday life (Dipalaya et al., 2022). The application of mathematics, especially geometry in everyday life is very much. The role of geometry that can be used is in the manufacture of houses. In its development, the house as a shelter and has a variety of shapes, sizes and designs. One of them is a house on stilts which has

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a number of advantages, including as a unique traditional house identity in the people of Timor-Leste, safe and inhabited by local people, and a wider yard, a strong traditional impression, a unique shape, and a cooler interior. One of the roles of geometry in the traditional house of Timor-Leste is called “Uma Lisan”. (Molinares & Varilla, 2017). This study aims to determine the results of exploration and the role of ethnomathematics on geometric patterns in the referring traditional house, Buruma, Baucau. (Kadir, 2023).

Timor-Leste has a rich and diverse traditional architectural heritage, which reflects its cultural identity, values and local environmental conditions (Da Costa et al., 2019). This traditional architecture often utilizes complex principles of spatial geometry to achieve specific functions and aesthetics. However, an in-depth understanding of how these spatial geometry principles are applied in Timor-Leste's traditional buildings is still poorly documented and studied (Dipalaya et al., 2022).

METHOD

This type of research uses a descriptive qualitative approach method (Creswell, 2014). According to research is a search effort that is very valuable educationally. The nature of research is basically not necessarily absolute truth. Qualitative research is conducted because researchers want to explore phenomena that cannot be quantified and are descriptive in nature such as the process of a work step in construction, the formula for a recipe, the understanding of a diverse concept, the characteristics of goods and services, the procedures of a culture, the physical model of an artefact, and so on (Yuningsih et al., 2021). In addition, according to Yuningsih et al., (2021) qualitative research methods are often also called naturalistic research methods because the research is carried out in natural conditions (natural settings), also known as ethnography methods, because initially this method was more widely used for research in the field of cultural anthropology; referred to as qualitative methods, because the data collected and analyzed are more qualitative in nature (Arokiasamy et al., 2023). This qualitative research is defined as a process of trying to get a better understanding of the complexity of interactions between human (Kurino & Dwi, 2022).

So, descriptive qualitative research aims to test certain hypotheses and make an accurate description of the facts. However, it must be the same as the reality

about the analysis of mathematical elements in the mentioning traditional house, Buruma tribe, Baucau Municipality. Researchers also tried to explore information through literature, observation and interviews with several figures or generations of indicating traditional houses in Buruma village, who knew information about the object of research.

Data collection techniques are methods used to obtain data or information needed in a study. Data collection is carried out to obtain relevant and accurate data and can be used appropriately. In this study, the data collection techniques used were observation, interview and documentation (da Costa et al., 2022). The observation technique in this study was carried out to find out data in the field regarding the geometry of spatial shapes in the architecture of the sacred traditional house (Assidiqi, 2024). This observation activity is carried out by observing the entire sacred traditional house building.

This type of interview, researchers conduct semi-structured interviews. This semi structured interview is freer and more flexible in its implementation when compared to structured interviews. Researchers conducted this interview activity starting from the issues covered in the interview guidelines (Waight & Stewart, 2005). This guideline researchers still use during the interview but only in line, then the researcher is conditionally developed when conducting questions and answers. With this, it is intended that during the implementation of question-and-answer activities an open and not rigid situation is created. The researcher interviewed the resource person is someone who is still a descendant of the referring traditional house, Buruma Village.

His technique of reviewing documents in this research is intended to be about photographs that are relevant to the geometry of the spatial structure of the indicating traditional house. In order for researchers to record everything that is written relevant in documents or archives related to the geometry of the building space in the architecture of this traditional house, then try to understand its purpose or meaning (da Costa et al., 2022). The purpose of this documentation method can be used to find secondary data on the referring traditional house.

This research instrument is used as a tool or facility used by researchers in order to collect data more easily and the results are better, in the sense that they are more complete, careful and systematic so that they are easier to process (Filomena et al., 2022). In this study, the instruments that researchers used were as follows:

(1) Researcher; (2) Observation guideline sheet; (3) Interview guideline sheet; (4) Documentation; (5) Stationery (Ratnaningtyas, 2022).

Data analysis is a process of making choices, inspection, discarding, eliminating, sorting, transforming and modelling and classifying data as expected. The data analysis technique that researchers use is adjusted to the type of data collected and data collection, this research data analysis is intera

ctive. Data analysis techniques can be used according to the needs of the researcher (Multisari et al., 2022). Qualitative data analysis is divided into four, namely domain analysis, taxonomy analysis, componential analysis and cultural theme analysis (Molinares & Varilla, 2017).

RESULT AND DISCUSSIONS

The traditional house that is the object of this research is the sacred traditional house. This house is located in Buruma village, Baucau Vila sub-district, Baucau district.

Figure 1: Samalari-Dirman Traditional House

This traditional house used to be the residence of ancestors from time to time. Similar to the function of a house in general, it is a place where humans live to shelter from all kinds of traditional activities, weather, and shelter from danger.

Ancestors from ancient times were the first generation to have lived in this place on behalf of the formation of a sacred village to establish a traditional house called Samalari-Dirman, finally the sacred traditional house was divided into four, namely the House (Oma Inawae, Oma Tameda Uaifanu, Oma Tameda Uaimuta no Oma Uaiula), and its generations have expanded everywhere. And at that time the leader by several generations starting from the first generation established the sacred traditional house village until the Portuguese era. And after the re-generation

in the Portuguese era in 1923-5 April 2017 was led directly by him "Co'oraco (Sacred name) and commonly called his baptismal name, namely "António da Costa Gusmão" he as a generation in the traditional house (Belo, et al, 2024). And at that time, he was also known or as "Rata Samalari", as the main figure or central figure in the sacred traditional house village. "Rata" means the main charismatic cultural and sacred respected given naturally by the referring traditional house. "Samalari" is the name of the village's traditional house, (Kadir, 2023).

According to Makassae grammar, the term "rata" is used to refer to an elder who is a strong generational or charismatic cultural figure in a particular environment. According to the Big Indonesian Dictionary (KBBI), the term rata is defined as a grandfather who has the same height and or the same low; as a natural corner of nature. The mention of rata by the local community has an important meaning that this person is highly respected and is an icon of pride for the traditional community. He is a traditional figure who is ware, and masters' various disciplines, morals and ethics in the culture (Hardy & Bryman, 2012).

This referring traditional house has been established since the time of our ancestors, to the Portuguese-Dutch, Japanese, Indonesian and Timor Leste colonization, which is around the 2nd century BC. Samalari traditional house has been since 101M to 200M, which is contemporaneous with the period of East Timor. This house is used as a sacred for preservation and used as a place for traditional ceremonies/traditions "Ledana". And also, for centuries as a place of residence for ancestors and generations from time to time until now.

Philosophical Meaning of Samalari Traditional House

The Samalari traditional house is still maintained, as a tribute to the ancestors and regeneration of the "Rata Samalari" generation who have struggled to maintain and still develop their identity to spread traditional traditions, especially in Baucau district. The tradition of traditional houses especially in the Buruma village, Baucau district until now. Sacred traditional house has the construction of a rectangular house and a stage with a trapezium roof. The philosophical meaning of the shape of the rectangular house and the stage is that humans do not live in the sky or heaven, nor do they live in the underworld. Therefore, humans must live and

stay in and on the centre stage as a place to make traditional ritual events every year such as “sau batar, sau haree”, traditional ceremonies when people or generations of the traditional house when they die are called oral “Ledana”. The concept is expressed in the form of a house on stilts as a realization of the concept of thought. In addition, the stilt house has a deep meaning about the pattern of life balance, which must be in harmony between horizontal relationships (the universe) with vertical relationships (between humans or generations).

Figure 2: Traditional house models retained and modernized

Ethnomathematics Activities Ethno-mathematical activities in the traditional house are location determination activities, measuring activities and design activities. The measuring activity that exists in the sacred traditional house is on the face of a square-shaped house with a block building, with the same size area of 6 m x 6 m and a height of 3 m. indirectly the referring community has implemented measuring activities. The activity of determining the location of the traditional house lies in the placement of house ornaments to make it look beautiful, such as the placement of doors facing north, stairs to enter the stage, and ahi matan in the corner of the southern part and in the corner of the eastern part for special sacred places / rituals.

Another important and universal source of ideas in mathematics is the activity of making designs that has been applied to all kinds of tribes and cultures, especially the Buruma. If the activity of determining location is related to the position and orientation of a person in the natural environment, then the activity of making designs is related to all the objects produced. The activity of making designs is also related to other ethnomathematics activities, namely the activity of calculating according to mathematical space.

When planning to build a house, they calculate how many materials are

needed. For example, how many poles to cast the house, wood, walls, doors, windows, roof tiles and so on. In this traditional house, there are 12 house poles and there are also 16 supporting house poles inside the house, with the same distance from one another, and 12 house poles and 16 house poles under the roof or foot of the house at the bottom of the traditional house with the same distance. In addition, there are 4 house poles located between 12 or 16 house poles as the center of the board used as the floor, and also the stairs of the house. And surrounded by bamboo walls on the upper floor of the 4 pillars as sacred used to be used as a special place for rituals in ordinary customs such as sau batar, sau hare and a special place for conversations with ancestors in the "Ledana" custom.

Geometry Concept in Sacred Traditional House

There are several geometry concepts in the design of the traditional house, namely the concept of flat shapes, the concept of flat-sided space, the concept of relationships between lines, the concept of angles, and geometric transformations.

Flat Buildings

Flat shapes are the name for two-dimensional shapes. A flat shape is a flat area bounded by straight lines or curved lines. Flat buildings found in the sacred traditional house include:

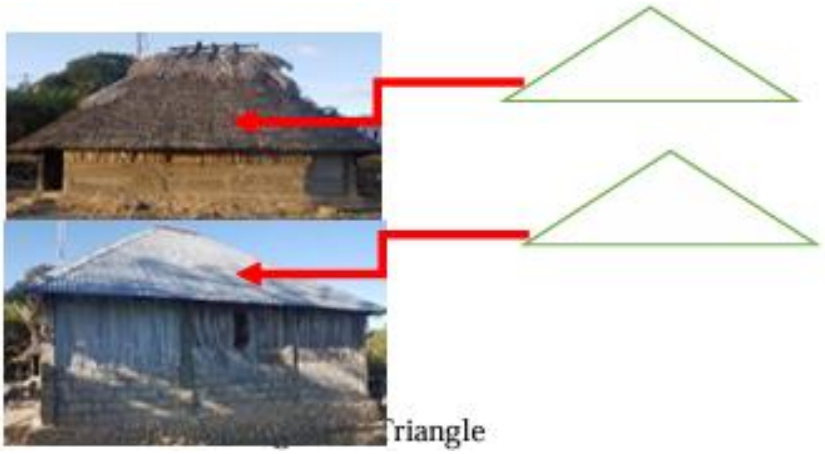

Figure 3: Triangle

The triangular building found in the referring traditional house is formed by the suhunan or roof of the house.

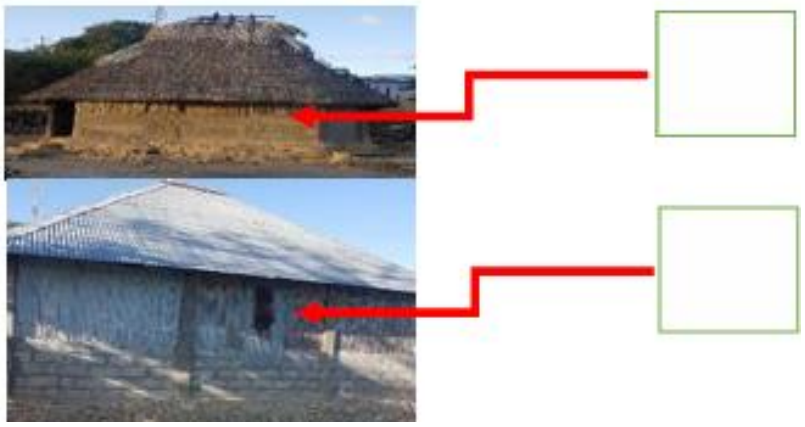

Figure 4: Square

The next flat shape is found on the door leaf and window leaf of the house which shows a square shape. A square is a flat shape bounded by 4 equal sides. A square is a flat shape that has the same parallel sides and has 4 right angles. The doors and windows of this house have a door size of 1.50 and a window of 80 cm each side.

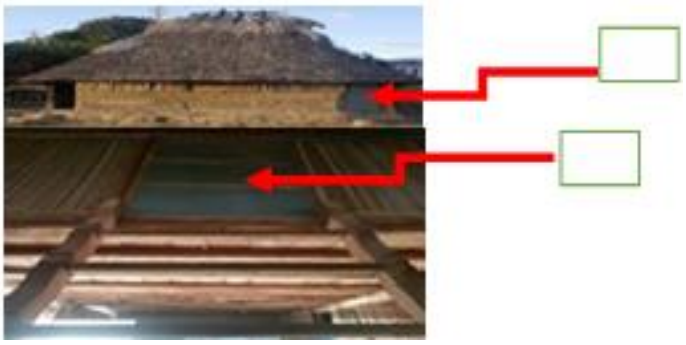

Figure 5: Rectangle

In addition to the square flat shape, the shutters of the sacred traditional house form another flat shape, namely a rectangle. Rectangle is a flat shape where the length of the long side is longer than the length of the wide side, where the opposite sides are equal in length.

Figure 6: Trapezoid

A trapezoid is a rectangular shape that has exactly one pair of parallel sides. Figure 6 shows an isosceles trapezoid on the ornament on the roof of the sacred traditional house.

Build a Space

Three-dimensional geometry or often referred to as building space is a mathematical construct that has content or volume. Three-dimensional buildings have 3 components, namely sides, ribs and corner points. The concept of three-dimensional geometry found in the referring traditional house is in the pillars of the house in the form of tubes and blocks.

Figure 7: Tube

And also three-dimensional geometry or often referred to as building space is a mathematical construct that has content or volume. Three-dimensional buildings have 3 components, namely sides, ribs and corner points. The concept of three-dimensional geometry found in the referring traditional house is in the beam-

shaped house pillar.

Figure 8: Parallelepiped

Wooden rods for as a base to hold on the pillars of the house with various shapes and functions to make the level of the house and make a slope model according to the model of building space.

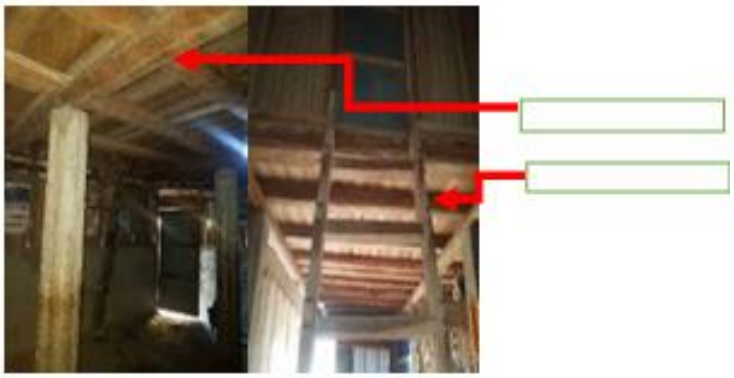

Figure 9: Wooden form of the term "Utunu/Leba, sara"

The perimeter wall of a house from the original pole (domain) to another pole (codomain) in quadratic form

Figure 10: Square

Concept of Line

The simplest geometry concept is through lines included in the subject matter of lines. In the sacred traditional house, there are vertical and horizontal lines. In the elements of art, the line itself has the ability to express an impression of beauty. The straight line found in the referring traditional house has a firm, rigid and strong meaning. The straight lines found in the mentioning traditional house are:

Figure 11: Horizontal Lines

Figure 12: Vertical Lines

Figure 13: Perpendicular Lines

Geometry Transformation

There is a concept of geometry transformation in the sacred traditional house, namely:

Figure 14: Reflection

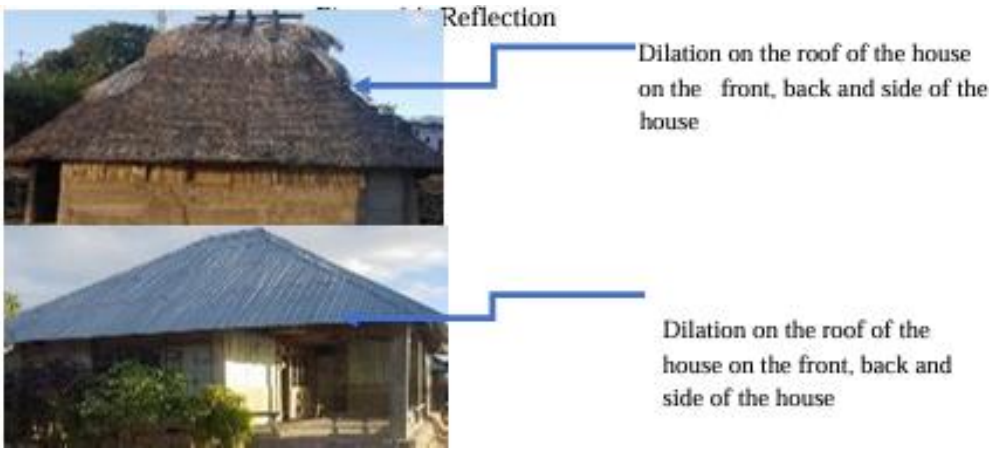

Figure 15: Dilation

CONCLUSIONS

Based on the results of the research conducted, it can be concluded that the indicating Traditional house, Buruma, Baucau, has a close relationship with mathematics learning or commonly referred to as ethnomathematics-based learning. The traditional house has many geometry elements including (1) the shape of the roof of the house is triangular, trapezoidal, the poles in the traditional house are in the form of tubes and beams, (2) the top/ ceiling in the house has a square element, (3) the walls of the house are square, and (4) the logs above the mentioning traditional house poles are in the form of beams. In general, it can be concluded that the referring traditional house, Buruma Village, Baucau municipality can be an alternative in learning resources for Mathematics on the concept of geometry of space concepts in the mathematics laboratory, Superior Cristal Institute, Dili.

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