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Uma Lengge Traditional Building as a Source of Ethnomathematics-Based Mathematics Learning Implementation

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Kata Kunci:
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Abstrak: *Uma Lengge* adalah bangunan tradisional yang berada di kecamatan wawo Bima. *Uma Lengge* memberikan gambaran tentang kekokohan bangunan tradisional yang memiliki citra indah dan rapi dengan merefleksikan bentuk geometri. Tujuan penelitian ini ialah mendeskripsikan bangunan tradisional *Uma Lengge* sebagai sumber implementasi pembelajaran matematika berbasis etnomatematika. Metode yang digunakan dalam penelitian ini ialah eksploratif-deskriptif dan melibatkan pengrajin bangunan tradisional *Uma Lengge* sebagai sumber data utama. Teknik analisis data yang digunakan, antara lain reduksi data, penyajian data, dan verifikasi. Hasil penelitian menunjukkan bahwa terdapat konsep matematika berupa pengukuran dan aplikasi hitung tradisional masyarakat Bima. Selain itu, terdapat konsep geometri bangun datar dan ruang, serta konsep matematika pada proses pembuatan *Uma Lengge*. Hal ini membuktikan bahwa *Uma Lengge* dapat menjadi sumber penerapan pembelajaran matematika berbasis etnomatematika, karena pembelajaran matematika yang baik harusnya memiliki hubungan dengan realitas kehidupan masyarakat, salah satunya budaya.

Keywords:
Traditional Buildings; Culture and Mathematics; Uma Lengge

***Abstract**: Uma Lengge is a traditional building located in the Wawo Bima district. Uma Lengge illustrates the robustness of traditional buildings that have beautiful and neat images by reflecting geometric shapes. The purpose of this research is to describe the traditional building of Uma Lengge as a source of implementation of ethnomathematics-based mathematics learning. The method used in this research is exploratory-descriptive and involves traditional building craftsmen like Uma Lengge as the main data source. Data analysis techniques used include data reduction, data presentation, and verification. The results showed that there were mathematical concepts in the form of measurement and the application of traditional arithmetic for the Bima community. In addition, there are geometrical concepts of plane and space, as well as mathematical concepts in the process of making Uma Lengge. This proves that Uma Lengge can be a source of applying ethnomathematics-based mathematics learning because good mathematics learning should have a relationship with the realities of people's lives, one of which is culture.*

INTRODUCTION

Indonesia is a nation that has a wealth of culture, ancestral heritage, and local wisdom (Sukarni & Windhari, 2017). This is because Indonesia is inhabited by various tribes with the characteristics of their respective regions, both in terms of language and customs. Whether we realize it or not, of the many cultures that have been attached to people's lives, of course, some have a direct relationship with mathematical concepts (Jayanti & Puspasari, 2020). The existence of this linkage has begun to attract the attention of the government to make policies regarding mathematics and cultural learning in education, thus giving birth to a new type of learning called ethnomathematics (D Herawaty dkk., 2018; Richardo, 2017).

Ethnomathematics is defined as a mathematical activity carried out by certain cultural groups in people's lives (Hadi et al., 2022; Ulum et al., 2018). Ethnomathematics is also a field of science that studies and explores how people from different cultural backgrounds understand, pronounce, or use cultural concepts related to mathematics (Mulyani & Natalliasari, 2020). So much of the discussion in ethnomathematics is related to how people understand, express, and use cultural concepts that are described mathematically (Putri, 2017).

Advances in science provide space for the application of ethnomathematics in schools to overcome complex problems, especially in learning mathematics (Putri, 2017). So the application of ethnomathematics began to develop rapidly in Indonesian education (Hadi et al., 2022; Widada et al., 2019). Ethnomathematics was born through traditional community habits, one of which is in the form of traditional buildings in the form of traditional houses, namely *Uma Lengge* (Hasliyati et al., 2021).

Uma Lengge is a traditional house located in the Wawo Bima District, West Nusa Tenggara Province (Argubi et al., 2019; Hasliyati et al., 2021). *Uma Lengge* is also a traditional building that functions as a rice barn for the local community, and can still be found in remote areas of Bima to this day. The local community calls this traditional building conical in shape, but if examined mathematically the architecture of the building reflects a three-dimensional building, namely a triangular prism (Hasliyati et al., 2021).

Uma Lengge has three rooms, including the *ro awa*, *ro woha* and *ro ese* rooms. *Ro awa* is an open basement made of bamboo which is usually used as a place for livestock such as chickens and goats. *Ro woha* is an open living room consisting of four main pillars which are usually used as a place to rest and receive guests. The room is the main room (top) in the form of a triangular prism that functions as a place to store food supplies (Hasliyati et al., 2021).

The traditional *Uma Lengge* building is closely related to mathematical concepts. In addition, previous studies related to *Uma Lengge* have been carried out, namely the research of Hasliyati et al. (2021), which discusses the ethnomathematical exploration of *Uma Lengge*. The results of his research show that the measurement method used by the traditional Bima community is closely related to mathematics. In the design of the *Uma Lengge* building, there is a geometric concept of flat wake and space. This fact illustrates the important role of culture in understanding mathematics and provides insight for us that the study of mathematics also includes cultural life.

Through the description above, it is explained that the presence of ethnomathematics in *Uma Lengge* is one solution to innovate on conventional learning (Hasliyati et al., 2021). This is because learning should be built by linking learning materials with realities in everyday life, because mathematics has grown and entrenched in students' lives in society (Putri, 2017; Sandhi et al., 2018). By conducting a study on cultural concepts that touch the mathematical picture, especially in *Uma Lengge*, it is hoped that it can open up new learning spaces and experiences in understanding mathematics conceptually based on culture. Therefore, the discussion in this study will focus on how the traditional building of *Uma Lengge* is a source of implementation of ethnomathematics-based mathematics learning?

METHOD

This research is exploratory-descriptive research that aims to explore the existence of components and architecture of the traditional *Uma Lengge* building. Then, as a source of ethnomathematics-based learning, describe the geometric concepts contained in the traditional building.This research was conducted in Maria village, Wawo Bima sub-district, which is the development of a cultural tourism village, where the *Uma Lengge* building is still found in the area.

Respondents in this study were determined by a purposive sampling method, namely the guards or those who protect the tourist sites of *Uma Lengge* traditional buildings, culturalists, and craftsmen as the makers of *Uma Lengge* traditional buildings. The research was conducted based on the flow, including documentation of everything related to the traditional *Uma Lengge* building. After that, interviews were conducted with the respondents who had been determined, and finally the results and conclusions were drawn from the research. Data analysis techniques used include data reduction, data presentation, and verification.

RESULTS AND DISCUSSION

Results

The Mbojo tribal community in ancient times had a special building as a place to put food supplies, commonly called *Uma Lengge* (Suwantara et al., 2012). The main components of *Uma Lengge* form an architecture that represents the robustness of the building (Angelita et al., 2019; Nurhafni, 2017). The roof is divided into two sides, namely the front and back sides, in the form of a triangular prism. When it descends to the lower room, which is formed from the four main stage pillars, it forms a cube (Sartika et al., 2017).

When viewed only from the front, *Uma Lengge* has a roof that appears to be in the form of a rectangular pyramid composed of layers of closely lined reeds. In addition, through observations, it appears that *Uma Lengge* has a terrace at the bottom which is usually used to sit on or receive guests in the form of a cube. Based on the results of research conducted by Hasliyati et al. (2021) related to the ethnomathematical exploration of *Uma Lengge*, the following facts were found.

Mathematical Activities in the Design of *Uma Lengge*

Uma Lengge illustrates the relationship between culture and mathematics because human culture cannot be separated from mathematics. This indicates the important role of mathematics in solving everyday problems. In the traditional building design of *Uma Lengge*, there are mathematical activities that are known through the traditional measurement methods used by the Bima community.

The process of making *Uma Lengge* in ancient times used the traditional Bima measurement method. The measurement techniques are very diverse, starting from using the fingers, *sakimi* (fist), measuring *sasingku* (one fathom), and at a size that is more than one meter, it is done by extending one hand and folding the other hand in half. In general, this method of measurement is carried out by adults, while the results of children's measurements are not the main standard in the use of *Uma Lengge* measurements. In addition, an interesting fact is that each *Uma Lengge* is usually determined by the size of the hand of the owner according to the instructions of craftsmen and tribal chiefs.

The Concept of Flat Shape Geometry at *Uma Lengge*

Furthermore, the results of the study by Hasliyati et al. (2021) related to the ethnomathematical exploration of *Uma Lengge*. The traditional building has an architectural form that describes several types of flat shapes. Flat geometry concepts include:

- The principle of the triangle in *ceko*. *Ceko* is a pair of squares forming a right triangle pattern to strengthen each post.
- The *lante* has a square pattern. *Lante* is the middle floor, formed from an arrangement of betel nuts and coconut trees in the shape of a square that serves as a place to sit and receive guests.
- *Kabu tadancai* has a rectangular pattern. *Kabu tadancai* is a door cover that forms a rectangle.

Constructing Space Geometry Concepts at *Uma Lengge*

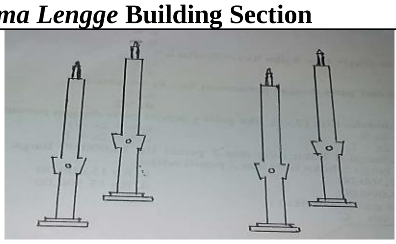
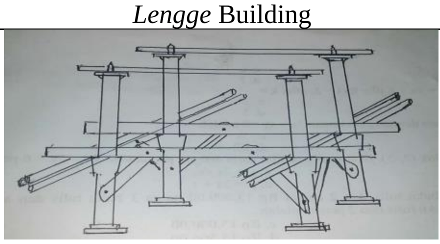
Based on the results of the study, Hasliyati et al. (2021) related to ethnomathematical exploration in *Uma Lengge* also has an architectural form that describes several types of spatial structures. For more details, the concepts of spatial geometry in these traditional buildings include:

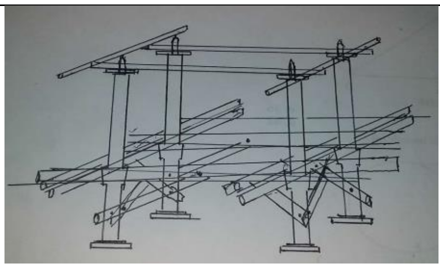
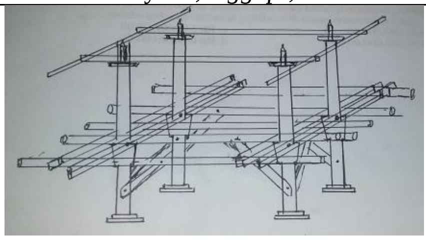
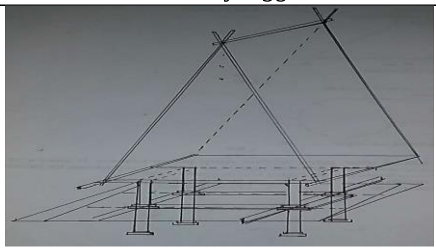
- The principles and concepts of a triangular prism on the roof. The roof of *Uma Lengge* is made of reeds or bamboo shingles, which are commonly found in the forest. The traditional Bima community uses materials from nature because in ancient times, there were no modern building materials. The roof of *Uma Lengge* has the shape of a triangular prism built in three-dimensional space, which is bounded by the base and the lid, which reflects a triangle, and the sides are rectangular.
- *Ro woha* cube concepts and principles. *Ro woha* is an open space consisting of four main pillars which are usually used as a place to rest and receive guests.
- Concepts and principles of blocks in *nggore*. *Nggore* is a beam that is installed on top of the response with a certain size and distance adjusted to the size of the *Uma Lengge* building.
- A lamp with a pyramid frustum concept. The lamp is a piece of wood in the shape of a pyramidal frustum that serves as a barrier for mice to enter the barn space where the food supply is.

Geometry Concepts in the Process of Making *Uma Lengge*

Furthermore, in this study, there are further exploration results related to ethnomathematics in *Uma Lengge*. This is evidenced by the existence of mathematical concepts in the process of making *Uma Lengge*. More details can be seen in table 1.

Table 1. Exploration of mathematical concepts in the process of making *Uma Lengge*

Num	*Uma Lengge* Building Section	Mathematical Concept Exploration
1	 **Figure 1.** *Ri'i* or pillars of the *Uma Lengge* Building	Based on Figure 1, it is known that the *Uma Lengge* building has a *ri'i* or foundation, in the form of pillars of four diagonals that are placed parallel to each other, and reflect the shape of the beam. Thus, *Uma Lengge* can become a traditional building that builds local people's understanding of the relationship between culture and mathematics, namely geometry.
2	 **Figure 2.** The shape of the building after the clamp is installed, namely n*ggapi*	Through Figure 2, information is obtained that the *Uma Lengge* building describes the shape of the beam which is a pair flanking the pillars. If the beam were placed horizontally, it could seek an approach between mathematics and culture, in the form of geometry.

3	 **Figure 3.** The shape of the building installed by *ri'i*, N*ggapi*, and *ceko*	Based on Figure 3, it is known that the structure of *Uma Lengge* reflects the shape of a triangle. The square or *ceko* part of the *Uma Lengge* in the form of a right triangle can be used to seek an approach to the mathematical material, namely triangles.
4	 **Figure 4.** The shape of the building installed by N*ggore*	Based on Figure 4, we get the *Uma Lengge* structure, which introduces the shape of the beam as the basic structure of the floor of the *Uma Lengge* middle building. So, in this case, there is an approach to mathematics material towards culture, especially geometric materials, namely beams.
5	 **Figure 5.** The shape of the roof of *Uma Lengge*	Based on Figure 5, it is known that the roof of *Uma Lengge* reflects the shape of a triangular prism. This explains that *Uma Lengge* as a traditional building, has a close relationship with the daily environment or culture of the local community. So it is possible to have a cultural approach to the mathematics of geometric materials, namely a triangular prism.

The concept of calculating algebra in the traditional society of Bima

The Mbojo people have their own philosophy of counting numbers. In the living tradition of the Mbojo tribe, an odd count is a form of integration of their daily activities and actions with religious values. Based on the Mbojo philosophy, odd is a number that is favored by God, as this has been inherent in the beliefs of the Mbojo tribe. In addition to odd numbers in the process of making *Uma Lengge* also uses traditional calculations and measurements with simple arithmetic operations, namely addition and subtraction on long, short and wide, and narrow *Uma Lengge* buildings. With an approach like this, students are expected to be able to more easily recognize math concepts.

Discussion

In the language, *Uma Lengge* comes from two syllables, namely, Uma which means house, and Lengge which means conical. Furthermore, based on its function, *Uma Lengge* is a traditional rice barn house, and part of the ancestral culture of the Mbojo tribe. Until now, the *Uma Lengge* building can still be found in the cultural area of NTB, precisely in the village of Maria, Wawo sub-district by some people who live around cultural tourist attractions (Hasliyati et al., 2021).

The structure of the *Uma Lengge* building has a height of approximately 5 to 7 meters, with the shape of the building reflecting the shape of a triangular prism. Based on the results of the ethnomathematical exploration of *Uma Lengge*, it was revealed that there are mathematical concepts in the form of measurement and the application of traditional arithmetic for the Bima community. In addition, there are geometric concepts of flat and space, as well as mathematical concepts in the process of making *Uma Lengge*. This proves that traditional building has a close relationship with mathematics (Hasliyati et al., 2021).

Through the description above, it is emphasized that *Uma Lengge* can be a source of applied mathematics learning in schools. This is because learning mathematics should be connected with the realities of people's lives because mathematics is part of students' culture in life (Putri, 2017; Sandhi et al., 2018). In addition, learning mathematics through culture is also very interesting because there is social interaction between students so that learning becomes more meaningful (Elly Susanti dkk., 2020; Sudirman dkk., 2017). Thus, *Uma Lengge* can be used as a reference regarding the context of the discussion of mathematics to help and facilitate students' understanding of concepts and to build students' creative thinking in solving mathematical problems.

CONCLUSION

Based on the results and discussion, the conclusion of this study is that there is a mathematical concept in the form of measurement and the application of traditional arithmetic for the Bima community. In addition, there are geometrical concepts of plane and space, as well as mathematical concepts in the process of making *Uma Lengge*. This proves that *Uma Lengge* can be a source of applying ethnomathematics-based mathematics learning because good mathematics learning should have a relationship with the realities of people's lives, especially culture.

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