Exploration Ethnomathematics on Traditional House Ume Kbubu in North Central Timor Districts

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Abstract. One solution to preserve the culture that exists in each region is to introduce culture to students through the world of education especially mathematics education. It is said so because mathematics has actually been applied by the community in various daily activities. Introducing culture through mathematics learning can be done by observing regional culture, exploring the mathematical concepts contained in the culture and then applying it in class learning. The purpose of this study is to explore the hidden mathematical concepts in the traditional house of Ume Kbubu in North central Timor (TTU) Districts. This research is a qualitative research with ethnographic approach. Data collection techniques through interviews, observation, and documentation. Data analysis techniques were carried out by data reduction, data presentation and conclusion drawing. The results of this study were mathematical concepts contained in the structure of Ume Kbubu buildings in TTU Regency including cones, tubes, circles, squares and similar concepts. From these results it can also be explained to students about points, lines and angles. Through mathematical concepts which found it can be used to facilitate students to understand the abstract mathematical concepts. In addition, it can also be used as a tool to introduce students to the existing culture.

1. Introduction

The 4.0 industrial revolution is a period in which the flows of globalization accompanied by increasingly sophisticated technological developments are developing rapidly and comprehensively. Ministry of Research, Technology, and Higher Education (2018) stated that the 4.0 industrial revolution is a period time when information technology became the basis in human life. The 4.0 industrial revolution has a complex impact and affects many aspects of human life such as the economic, politic, culture, education, etc. Advances in information technology make it easier for the society to obtain various information nationally and internationally, which results in changes of the local community’s lifestyle. The culture and tradition that exist in each region can also be forgotten due to the influence of foreign cultures and the lack of knowledge, especially the young generation of the local culture itself. Based on these problems, various efforts are needed to preserve and introduce the existing of regional culture.

One effort that can be done to preserve culture is through the education, i.e. by introducing students to the local culture, especially the culture of the region where the student are come from. Education and culture are two basic elements that cannot be separated from human life since culture is a way of life in a society and as a work of society that is comprehensive and complex. Education on the other hand
is seen as the need of every person to develop their potential through a learning process (Putri, 2017: 21).

Mathematics as part of education also has a role in maintaining culture since mathematics is attached and appeared in the culture itself. The process of maintaining culture can be done by observing the local culture then exploring the mathematical concepts contained in that culture for then applying it in the classroom learning (Dominikus, 2018). For instance, research done by Deda and Disnawati (2017) about The Relationship between Dawan Tribal Woven Motifs and School Mathematics. Further, Deda and Amsikan (2019) on their research revealed that there were four woven fabric motifs in the Kefamenanu society which contained cultural values and geometry concepts that could be used in mathematics learning.

Mathematics learning that is connected to culture or people's daily habits can be used as media in increasing interest in learning mathematics. In addition it is also used as media to maintain the culture itself. Therefore, in the process of learning mathematics it is necessary to relate between mathematics in schools and mathematics in daily life based on local culture. This is in line with D'ambrosio (2001) who argued that mathematics learning will be more meaningful if it is adjusted to the existing regional culture. The relationship between culture and mathematics learning at school is known as ethnomathematics.

D'Ambrosio in Rachmawati (2013: 4) stated the term ethnomathematics is interpreted as a mathematical concept that is applied in a community. Putri (2017: 24) revealed that ethnomathematics is formed of ways or habits that are able to be blended with the local traditions. From the views mentioned above it can be concluded that ethnomathematics is mathematics that grows and develops in a society through the habits of the local society.

Research on ethnomathematics has been conducted by previous researchers. Rosa and Orey (2011) revealed that a learning process by implementing social and cultural approaches could develop students’ thinking skills. Students’ social, emotional, and political learning will be effectively done by applying cultural references. This would result in better knowledge, skills and attitudes.

Zayyadi (2017) asserted that learning mathematics based on local culture makes it more meaningful as it is familiar to students and the contents are already found in their own cultural environment. Abstract mathematical concepts will become concrete if the students already know the mathematical concepts that exist in their existing culture.

Similar to other regions that have unique cultures that can be used as media in explaining mathematical concepts, TTU district also has its own culture that can be applied in mathematics learning, one of which is its traditional house, *Ume Kbubu*. *Ume Kbubu* is a house which roof is close to the ground and some also reach the ground. This roof is made of reeds leaves tied with forest ropes (Banamtuan, 2015). Amsikan and Nahak (2017) stated that in *Ume Kbubu*’s architectural structure there are elements that can be explored into mathematics learning, especially in the fields of geometry such as points, lines and angles.

Based on the description above, the purpose of this study is to investigate the mathematical concepts hidden in the *Ume Kbubu* traditional house in North East Timor Regency.

### 2. Research Method

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In conducting this research, the researcher used qualitative research with an ethnographic approach. Ethnography is a written detail or material regarding the social activities of a community group that is used to describe, explain and analyze the cultural elements of a society or an ethnic group (Kuswerno, 2008: 32). The instrument that used in this research are interviews, observation and documentation. This research was conducted in the village of Naipesu, West Miomaffo sub-district. The researcher himself went to the field to collect the data.

The data was analyzed by using Miles and Huberman model which consisted of 3 stages, namely data reduction, data presentation and conclusion or verification. Data reduction is a step to convert recorded
data or images into written form and select the data that is needed and which is not needed. Next, data presentation. At this stage, the researcher presented the result of data reduction. After the data was presented based on the results of data reduction, the researcher drew the conclusions based on the research problem.

3. Research Results and Discussion
Ethnomathematics approach in Ume Kbubu traditional house can be seen from the structure of the buildings. Ume Kbubu traditional house contains many mathematical elements that can be applied in mathematics learning, especially in the field of geometry. Geometry elements that can be explored in mathematics learning include: the shape of the roof, attic poles, doors, as well as takpani (wood which is wrapped around a circle on a roof located on the Ume Kbubu roof. The results of ethnomatematics research at Ume Kbubu can be seen in Table 1.

| Numb. | Ethnomatematics | Mathematical Concepts | Implementation |
|-------|-----------------|-----------------------|-----------------|
| 1     | Roof            | *Ume Kbubu’s roof structure* |
|       | The roof of *Ume Kbubu* has several properties such as: a base or a circular floor, one vertex located on the top of *Ume Kbubu* roof, two curved sides on the floor and the roof. | The roof of *Ume Kbubu* has similarities with the properties of the cone. | The roof of *Ume Kbubu* can be implemented in mathematics learning, especially in building curved side spaces (cones) materials. |
| 2     | Door            | *Ume kbubu’s door structure* |
|       | The door of *Ume Kbubu* has two sides which are facing each other with the same length and parallel. | *Ume Kbubu’s door* has similarities with rectangles. | *Ume Kbubu’s door* can be implemented in mathematics learning, i.e. in the discussion of two-dimentional shape (rectangular). |
| 3 | Pole | Cylinder |
|---|---|---|
| The pole in *Ume Kbubu*’s has three sides (the bottom or base of the pole, the top and the outer layer of the pole), the base side and the top side of the pole have the same shape and size that is circular, the height of the pole is the distance from the base to the top side of the pole. | The pole on *Ume Kbubu*’s has similarities with the properties of the cylinder. |

**Building *Ume Kbubu***

| 4 | The frame of *Ume Kbubu*’s roof is similar to the following picture: |
|---|---|
| The picture on the left column shows the shape of *Ume Kbubu* Attic room shape |
| The pictures above show two buildings are cones in different sizes |
| The relationship between the attic room with *Ume Kbubu* as a whole can be implemented in mathematics learning especially in congruence material. |
Ume Kbubu comes from the word *Ume* which means house and *Kbubu* which means round, thus *Ume Kbubu* is defined as a round house (Amsikan, et al, 2017). *Ume Kbubu*’s roof is made of reeds that are almost touching the ground. It has diameter about 3 to 4 meters and about 3 to 3.5 meters long. The round shape of the house is caused by natural condition and the geographical location in the mountain and it becomes a comfortable place to stay and feels warm inside. *Ume Kbubu* has a small short rectangular door that makes everyone who enters and exits at any cultural event on that house must bow his/her body. The small door of *Ume Kbubu* has its own meaning, which is to teach that everyone must respect one to another. *Ume Kbubu* has also a cone-shaped attic that can be used as a place to store foods from the harvest such as corn, rice, and beans so that they won’t easily damaged. The smoke that comes from the kitchen under the attic in *Ume Kbubu* helps a lot in the process of food smoked so the food can last long. *Ume Kbubu* in Timor Island also has a solid cylindrical mast (*ni*) placed on a sacred stone (*ni baki*) and it is in the middle of the round house, which is usually surrounded by all family members in every cultural events and to communicate with the ancestral spirits (Dima, Antariksa, & Nugroho, 2013).

4. Conclusion
In the process of learning mathematics, learning resources that can be used not only come from books but also from the environment and culture. Based on the results of the previous data analysis and discussion, it can be concluded that the mathematical concepts contained in *Ume Kbubu* traditional house are cone, cylinder, circle, square and geometry concepts. Further these results can be explained more into points, lines and angles. Mathematical concepts found in *Ume Kbubu* traditional house can be used as media to introduce the abstract concepts to be concrete in order to be more understood by the students.
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