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Ethnomathematics Exploration on Calculation of Holy and Purifying Water Tubs at Raudlatul Ulum Islamic Boarding School

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Abstract

Mathematics and culture are things you can only do in your everyday life. There is a connection between mathematics and culture, commonly called ethnomathematics. Many people need to understand that culture is a fundamental concept of mathematics to apply ethnomathematics. The purpose of this research is to evaluate and also analyse in different ways the mathematical elements that occur naturally in the water tank building of the Raudhatul Ulum Islamic Boarding School, which is very important according to the mathematical aspects contained in the building. The results of this study indicate that the activities of the santri cannot be separated from washing clothes and even cleaning the body, as well as purification, which cannot be separated from the principles taught in Islamic scriptures (fiqh). This situation requires the construction of water tanks in Islamic boarding schools to be significant because the number of students in Islamic boarding schools is small but significant, and the water supply must be adequate according to Islamic religious law.

INTRODUCTION

Mathematics is a basic science that functions as a tool in studying other sciences (Fajriyah, 2018). Therefore, mastery of mathematics is a must, and it is essential to understand mathematical concepts well and correctly from the start. This is because the mathematical concept is a series of causes and effects. A method is created based on previous methods and becomes the basis for subsequent methods. Therefore, misunderstanding one way leads to misunderstanding the subsequent ways.

According to Rosida (2016) mathematical knowledge can be obtained in a structured mathematics learning system in and outside school. For example, in life in Islamic boarding schools. Many learning processes in Islamic boarding schools are related to mathematics, especially in improving the balance of reasoning, problem-solving, reasoning and communication. This learning can also be more contextual if applied to culture-based learning. Culture-based learning is a strategy for creating a learning environment and designing learning experiences that integrate culture as part of the learning process. This is what money means in ethnomathematics. Ethnomathematics plays a role in connecting mathematics with culture, so it is hoped that it can arouse students' interest in learning mathematics (Ditasona, 2018).

D'Ambrosio (1985) states that ethnomathematics is mathematics used and then

grows and develops in a cultural group in Santri and general groups. The practice of ethnomathematics cannot be separated from using mathematical concepts to create a unique, diverse and unforgettable culture (Maharani & Maulidia, 2018). Ethnomathematics uses mathematical concepts broadly related to various mathematical calculation operations, starting from measuring, calculating, determining patterns and grouping, and so on (Eriana et al., 2019).

This mathematical concept is also often used to solve problems in people's daily lives, such as calculating area or calculating profits and losses from buying and selling activities. However, social facts show that many people think that mathematics is a subject that can only be taught at school without practical application. Mathematics is considered a scary and boring subject that is useless in everyday life. Therefore, mathematics learning requires a unique approach that can be implemented effectively and change the views of students and society in general regarding mathematics education (Khairadiningsih et al., 2015).

Many students understand the importance of mathematics, but only a few are interested in studying it (Munawwaroh, 2016). One of the reasons is that students do not know that mathematics can be studied through a cultural approach. Therefore, there is a great need for studies that can bridge the gap between culture and mathematics. One study that can bridge the gap between education and ethnomathematics culture. Ethnomathematics is a form of mathematics education that is culture-based and influenced by culture. By applying ethnomathematics in learning, especially mathematics learning, students are expected to understand mathematics and their own culture better so that students can accept the cultural values inherent in national character from an early age.

Building a bathroom water tank is an example of applying mathematics outside of school. Large bathroom water tank buildings are often found in Islamic boarding schools. Islamic boarding schools are where students live and study (Afianto, 2015). In the past, Islamic boarding schools only included religious education. As time passed, Islamic boarding schools also started to provide formal information offered in other public schools (Yahya, 2015). Such Islamic boarding schools are called "modern Islamic boarding schools". Apart from studying the Koran, Hadith and the Book of Kings, students acquire knowledge of mathematics, physics, biology, English and other formal sciences. The goal is for students to remain academically competitive in today's millennium. This was demonstrated by one of the Islamic boarding schools in "Putukrejo Gondang Kaki" village where the researchers studied, namely the Raudlatul Ulum 2 Islamic boarding school.

Through this presentation, the researcher wants to conduct ethnomathematics research on the structure of the bathroom water tank at the Raudlatul Ulum 2 Islamic Boarding School to illustrate a connection between mathematics and everyday life as well as life or culture from Muslim students. Islamic Boarding School course teachers are expected to be able to use this study as a reference to stimulate students' interest in learning mathematics.

METHOD

This research aims to determine the influence or structure of holy water and purify it at the Raudlatul Ulum Islamic Boarding School. This research uses an ethnographic approach and qualitative descriptive data to obtain and explain general and detailed information (Singh & Dickson, 2002). The research implementation process takes place in three phases, the first of which is (1) data pre-analysis (this analysis is carried out by the researcher before data collection; this stage begins with a field evaluation to identify the problem or research objective). (2) on-site data analysis (or on-site sampling) and (3) general data analysis (collection, selection, and transformation of data into informative actions). This activity is usually applied to educational institutions, but some professions conduct data analysis daily, especially in engineering (Risdiyanti & Prahmana, 2018).

This data collection technique uses ethnographic principles or writing that describes the lives of people, groups or individuals. Ethnography is a method that is often used in the social sciences, especially anthropology and several branches of sociology, such as documentation of observations and field notes with original ethnographic descriptions (Noto et al., 2018).

RESULTS AND DISCUSSION

This research identifies various forms of use of ethnomathematics at the research location and then integrates them into mathematics learning activities using actual cases. One example is the water tank in Islamic boarding schools, as in Figure 1.

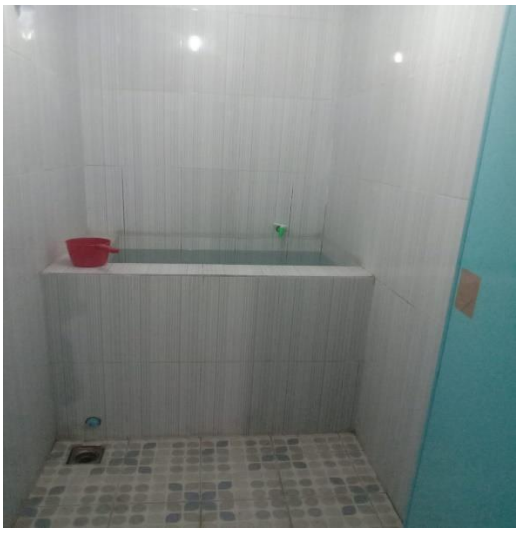

Figure 1. Water tank at Raudlatul Ulum Islamic Boarding School

In Figure 1, the bathtub measures 73 cm high, 52 cm wide and 115 cm long. If we use this method, we can invite students to determine the volume of a bathroom tub as an exercise or as an example of application using the concept of measuring the volume of a bathtub. A cube's height, width and length are known to be 73 cm, 52 cm and 115 cm. So, the volume of the tank, when complete, can be determined using the block volume formula, namely:

$$\boldsymbol{Tub\ Volume = p\ x\ l\ x\ t = 115\ x\ 52\ x\ 73 = 436.540\ cm^3}$$

436.540 cm^3r Equal to 436 (litre). According to Islamic religious law, water in the bathroom can be used for cleaning and purification. One of them is narrated by the Safinatun Najah fiqh law book; if the water in the tank is more than two kulas (270 litres), it can be used for cleaning (Muflihah, 2024).

The water source for filling the water tank in the bathroom comes from rainwater and drilled well water. During the rainy season, the water in the bathtub is always total; in other words, the water is always more than two kulas. However, if it is not rainy season, the water in the bathtub is not always complete. To accommodate the needs of Islamic boarding school students, 21 bathrooms of the same size are provided. With the large number of students in Islamic boarding schools, the water in the bathtub is used very often, for example, for bathing, washing, performing ablution, etc. This results in the water in the bathtub not always being filled. So there is a possibility that the amount of water will be less than two kulas (270 litres), which is the requirement for the amount of water that can be used for ablution.

To overcome this, the method used by Islamic boarding school administrators is to install a water tap in the bathtub. Two types of faucets are installed in the bathroom, namely ordinary faucets and automatic faucets, as shown in Figure 2.

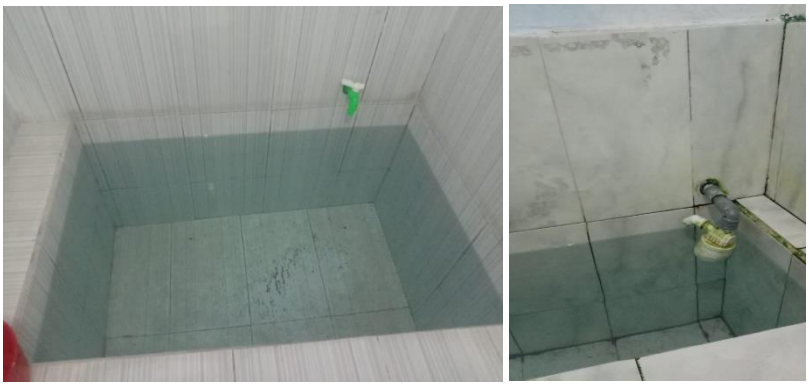

Figure 2. Bathtub with regular faucet and automatic faucet

With the same bathroom size, namely 115 cm long, 73 cm high, and 52 cm wide, then the limit for the amount of water that must be present (the amount of water that fills the bathtub) so that the water is valid when used for purification (reaches the limit according to Islamic law) is at over two kula or 270 litres, or when the water in the tank is at least 46 cm high. Because the volume of the bathtub when the tub water contains 46 cm is:

$$\boldsymbol{Tub\ Volume = p\ x\ l\ x\ t = 115\ x\ 52\ x\ 46 = 275.080 cm^3}$$

$275.080 cm^3$Is is the same as 275 litres (more than two kulas). This means that the water level in the bathtub cannot be less than 46 cm, or the water level in the bathtub must only decrease by 27 cm.

So that the water in the bathtub can still be used for ablution, the boarding school administrators arrange for the installation of a faucet. For automatic faucets, the limit when the faucet will start filling with water is when the water level has decreased by 20 cm. Meanwhile, for ordinary faucets, students in Islamic boarding schools are encouraged

to turn on the faucet when the water level has decreased by 1/2 tile (with a bathtub tile size of 25 cm x 40 cm). Another method Islamic boarding school administrators use is to put a mark on the inside bathroom tiles so that students will know the limit of water that can be used for washing.

CONCLUSION

From the presentation of the research description, it is clear that in the structure of the Islamic boarding school bathroom water tank, whether we realise it or not, we can find the application of mathematical concepts, namely calculating the size of the bathroom tank. The size of the bathtub made at the Raudlatul Ulum Islamic boarding school is adjusted to the limit of water that can be used for purification (2 kulas). To ensure that the water in the bathtub always contains two kulas, water taps (regular and automatic) are installed in each bathroom. According to Islamic religious law, This is regulated so that the water in the bathtub remains pure. This also shows the connection between mathematics, daily life, and culture in Islamic boarding schools.

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