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Ethnomathematics: Exploration of Geometry in Building Design Jatisobo Grand Mosque

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Abstract: Ethnomathematics is a learning innovation that combines the concepts of culture and mathematics in it. The purpose of this research is to explore and describe the design of the Jatisobo Great Mosque building in Sukoharjo district which has geometry concepts in it. Jatisobo Great Mosque is one of the oldest mosques and has also been designated as a cultural heritage in Sukoharjo district. Furthermore, the type of research uses qualitative research through an ethnographic approach. Then the research method uses 3 ways, namely surveys, interviews and documentation. With technical data analysis using Spradley's model through four stages namely domain analysis, taxonomy analysis, componential analysis and cultural theme analysis. This study shows the results that in the building design of the Great Mosque Jatisobo Sukoharjo district there is the concept of geometry. Geometry concepts such as flat shapes (square, rectangle, circle and triangle), space (pyramid, prism and tube), geometry transformation (reflection and dilation) and angle. These geometry concepts are found in the form of room plans, mosque roofs, mosque windows, mosque doors, supporting corners, drum, horns, and mosque poles, among others.

Keywords: ethnomathematics; geometry; jatisobo grand mosque.

INTRODUCTION

In education, subjects that must be taught at every level from elementary education to higher education are mathematics (Derivat, 2023). In addition to being taught at the education level, math is also very important for everyday life. In math, there is a structured, systematic and logical arrangement from easy to difficult levels. Ruseffendi in (Hidayat et al., 2023) stated that this aims to enable students to hone their ability to think critically, creatively, and logically. But at present, some students still think that math is a scary and difficult lesson to understand because in learning it only contains counting, memorizing formulas, and playing numbers that make them feel bored and lazy until students feel there is no more interest in learning math. Judging from the history of education, especially in Indonesia, it has undergone several improvements and changes to the curriculum with a predetermined goal to adapt to the progress and development of the times, in order to achieve satisfactory results (Maharani et al., 2023).

In the current era with the emergence of competition to improve quality and quality in various sectors, demanding all parties in various fields to continue to compete in improving the quality and quality. This shows that it is very important to continue to improve the quality of education (Hidajat et al., 2024) because education can be used as a place to shape the character and character of students. It is hoped that an increase in the quality and quantity or quality of education can have a positive impact, benefits and progress for education, especially in Indonesia, so as to produce the next generation of the nation with quality, quantity and broad insight. A superior quality education system can make a country recognized as a developed country by other countries (Agustino et al., 2024).

Geometry is a measurement science that studies a field, various fields of geometric shapes, namely rectangles, rectangles, triangles and circles are objects of the field studied through the scientific method (Surya et al., 2021). Geometry is also one of the branches of mathematics that needs real or contextual examples, not just abstract images. Learners really need a clear concept of geometry so that they can apply the skills they learn such as

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visualizing, recognizing various forms of flat and spatial shapes, describing an image and having the ability to recognize similarities and differences in geometry (Amaliyah et al., 2022). So there needs to be a learning that is able to facilitate students in understanding the concepts and forms of geometry more easily, because almost all visual objects around students are the implementation of geometry (Andriliani et al., 2022).

Ethnomathematics is an innovation in mathematics learning with the incorporation of local cultural concepts in it (Agustin et al., 2019). As Ethnomathematics can be interpreted as a study of mathematics that has a relationship with the whole culture and social life in society. A study that has examined the application of mathematics in a variety of cultural activities, shows the relationship between culture and mathematics, which we know as ethnomathematics (Lusiana et al., 2019). So ethnomathematics is called mathematics that grows and develops in the community according to local culture.

According to the Law of the Republic of Indonesia No. 11 of 2010 Chapter 1 article 1 "Cultural Heritage is an immaterial cultural heritage in the form of cultural heritage objects, cultural heritage buildings, cultural heritage structures and cultural heritage areas on land and / or in water that need to be preserved, because it has important value for history, science, education, religion, and / or culture through the determination process" (Metafani et al., 2020). A culture can stimulate learners' knowledge, especially cultures that are directly related to them in their daily lives, Rohaeti in (Yudianto et al., 2021). Cultural objects that are in the surrounding environment are the choice of means to realize this. One of them is a mosque building, there are several previous studies on ethnomathematics in building design. One of them is (Lusiana et al.,2019) at the Bengkulu City Jamik Mosque, (Wahyuni et al., 2024) at the Surakarta Great Mosque, (Yudianto et al., 2021) at the Jami' Al-Baitul Amien Jember Mosque, (Rizky et al., 2022) at the Menara Kudus. In the Sukoharjo district, more precisely in Jatisobo village, Polokarto sub-district, there is a mosque building that has been designated as a cultural heritage in 2024 by the Sukoharjo district government because of its history and is one of the oldest mosques. The Jatisobo Great Mosque is still active and is often used as a place of worship and religious activities by the surrounding community. Jatisobo Great Mosque is also known as the exact duplicate of the small version of Surakarta Great Mosque. Because according to its history, the wood in the Jatisobo Great Mosque building is the same wood in the Surakarta Great Mosque building. Thus, the author's aim is to describe and explore the existing ethnomathematics in the form of geometric shapes and concepts in the design of the Jatisobo Great Mosque building in Sukoharjo Regency, in order to make it easier for students to better understand the concept of geometry in real terms in learning mathematics at school which is usually only explained visually. This is in line with research conducted by (Sarwoedi et al., 2018) recommending that ethnomathematics in mathematics learning is more effective in improving the ability of students to get maximum results.

METHODS

The research method carried out uses a type of qualitative research method through the ethnographic approach method. Qualitative research is research that produces descriptive data from all forms of handwriting, speech or images of the subject or object under study (Waruwu et al., 2023). Ethnographic approach according to Meleong in (Asih et al., 2024) explains a step taken to describe or describe and analyze a culture on certain cultural aspects. The research instrument this time uses a human instrument, namely the researcher acts as the only instrument that cannot be represented by others. Researchers conducted research at the Jatisobo Great Mosque, Sukoharjo Regency. Data collection uses 3 steps, namely observation, interview, and documentation. Researchers conducted observations and also documentation to observe the building design of the Jatisobo Great Mosque. The subject of this research

interview is the mosque takmir Mr. Adi Sarmoko to obtain information related to the building and history of the Jatisobo Great Mosque.

This research uses (Qomaruddin, 2024) data analysis techniques which includes four stages, namely Domain analysis, Taxonomy analysis, Componential analysis, and Cultural or Cultural Theme analysis. In Domain analysis, researchers obtain an overview of the objects to be studied, then Taxonomy analysis selects certain objects that researchers have chosen to examine in more detail. Componential analysis is an analysis in finding specific objects that have been determined, and finally Cultural or Cultural Theme analysis combines all data to make it new data. Researchers use this method to find out, describe and understand how the exploration of ethnomathematics in the form of geometric shapes and concepts that exist in the design of the Jatisobo Great Mosque building in Sukoharjo Regency.

RESULTS AND DISCUSSION

Jatisobo Great Mosque was built during the reign of the King of Surakarta Hadiningrat Sunanate, Pakubuwono IV who ruled around 1788-1820. Pakubuwono IV ordered one of the scholars in the palace to go out to spread Islam to several areas including Jatisobo village. The name of Jatisobo village which was formed from the word “jatisebo” which means “coming to the palace” originated from a teak tree that was very unique, judging from its size it was also very large and tall, so that its shadow reached the Surakarta Kasunanan palace area. Then Pakubuwono IV ordered to cut down the teak tree and divided it into two, used to build the Surakarta Great Mosque and the Jatisobo Great Mosque. So there are similarities of buildings in some places such as the main hall of the prayer place and the front porch, although the size is different. Pakubuwono IV often performed Friday prayers and gave Friday sermons at the Jatisobo Great Mosque. Pakubuwono IV also built a library to the east of the main prayer room to deepen religious knowledge.

The following is an excerpt of an interview with the mosque takmir regarding the building and history of the Great Jatisobo Mosque:

P : What is the shape and concept of the Jatisobo Great Mosque Building?
N : The concept of the mosque building is the same as the mosque building in general, for the shape of the mosque it is the same as the shape of the Surakarta grand mosque building, according to Pakubuwono IV orders, only the size is different.
P : What rooms does the Jatisobo Great Mosque consist of?
N : There is the main room for prayer, there is a foyer, there is a library on the north side which was used as a place of study by Pakubuwono IV.
P : Is there a special rule regarding the determination of the size of the room?
N : No.
P : Is there a certain meaning of the size of the room?
N : I don't know that mba
P : What is the shape of the dome of the Great Jatisobo Mosque?
N : the same as the dome of a mosque in general
P : What is the shape of the roof of Jatisobo Great Mosque?
N : The same as the roof of the Surakarta Great Mosque because this mosque can be called a duplicate, only the medium version is not as big as the Surakarta Great Mosque.
P : Is there any particular meaning to the shape of the mosque's roof?
N : I don't know mbak
P : What are the types of pillars found in the main room of the Jatisobo Great Mosque?
N : There are 4 pillars and 12 other supporting poles.

P : Is there a special meaning for the columns of the Surakarta Grand Mosque that are shaped like that?
N : I don't know mbak
P : What is the shape of the Mihrab of Jatiosbo Great Mosque?
N : The shape is semicircular
P : Is there any special meaning, sir?
N: no mbak

Part of the building design of the Great Mosque of Jatisobo Sukoharjo district which has a geometric concept, namely the plan of the mosque room shape, mosque roof, mosque pole, mihrab, support corner, mosque door, mosque window, drum and mosque horn. The results of the analysis of research data that has been done on the building design of the Great Mosque of Jatisobo Sukoharjo district which contains geometry concepts, among others:

❖ Flat Shape

In the design of the Jatisobo Great Mosque building, there is the concept of flat shapes in the form of a mosque porch, the shape of the prayer room, the shape of the pulpit, the shape of the pillar, the shape of the mihrab, the shape of the mosque window, the shape of the mosque door and the mosque roof frame. Here are some flat shapes found in the design of the Jatisobo Great Mosque building:

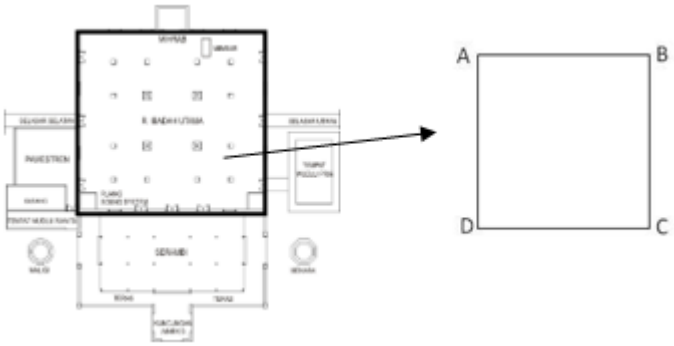

Figure 1. Mosque Prayer Room

The prayer space at the Jatisobo Grand Mosque contains the concept of square flat shapes that can be applied in the process of learning mathematics at school regarding concepts, properties and determining the area and perimeter of square flat shapes.

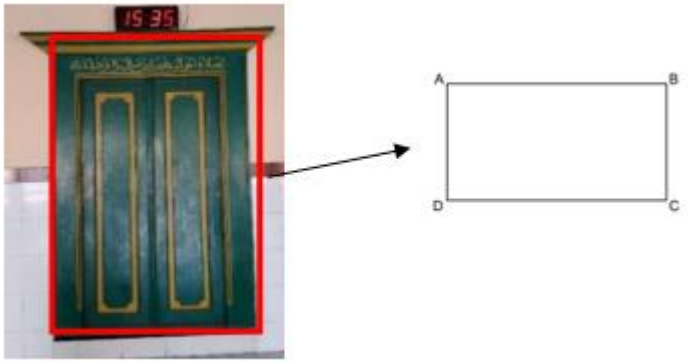

Figure 2. Mosque Door

The door of the Jatisobo Great Mosque contains the concept of rectangular flat shapes that can be applied in the process of learning mathematics at school regarding concepts, properties and determining the area and perimeter of rectangular flat shapes.

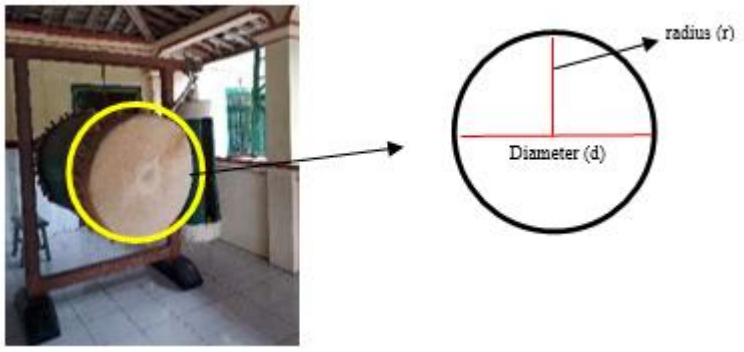

Figure 3. Mosque Islamic Drum

The Islamic drum of Jatisobo Great Mosque has a circle concept that can be applied in the process of learning mathematics at school regarding the concept, properties and determining the area and perimeter of the flat circle.

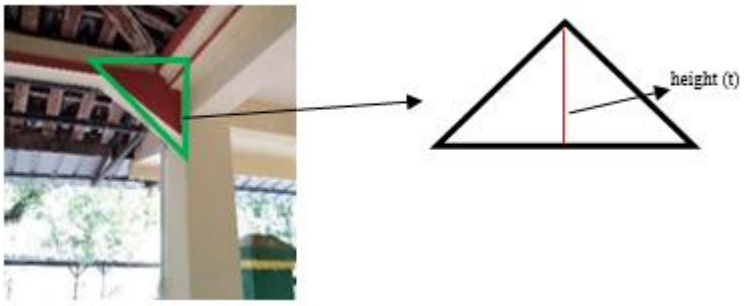

Figure 4. Mosque Support Corner

The corner supporting the Jatisobo Great Mosque has a triangle concept that can be applied in the process of learning mathematics at school regarding the concept of triangles and determining the height, area and perimeter of triangular flat buildings.

❖ Build Shape

In the design of the Jatisobo Great Mosque building, there is a concept of space in the form of a mosque roof frame, islamic drum, and mosque horn. Here are some of the building spaces found in the design of the Jatisobo Great Mosque building:

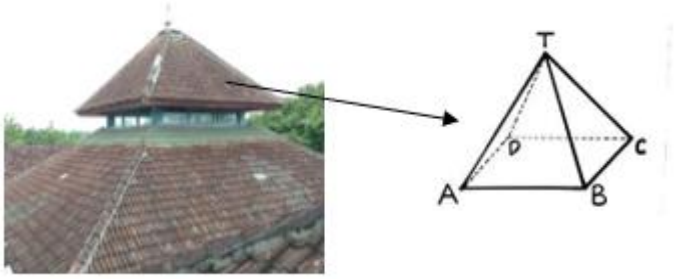

Figure 5. Mosque Roof

The roof of the Jatisobo Great Mosque has a pyramid concept that can be applied in the process of learning mathematics at school regarding the concept of properties and determining the area and perimeter of the pyramid.

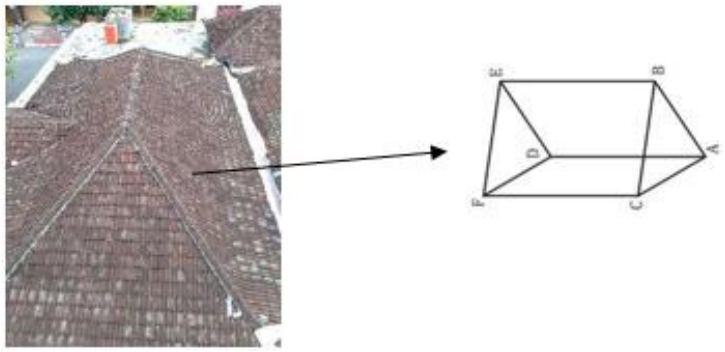

Figure 6. Mosque Roof

The roof of the Great Mosque of Jatisobo has the concept of prism that can be applied in learning mathematics at school regarding the concept of properties and determining the area and perimeter of the prism.

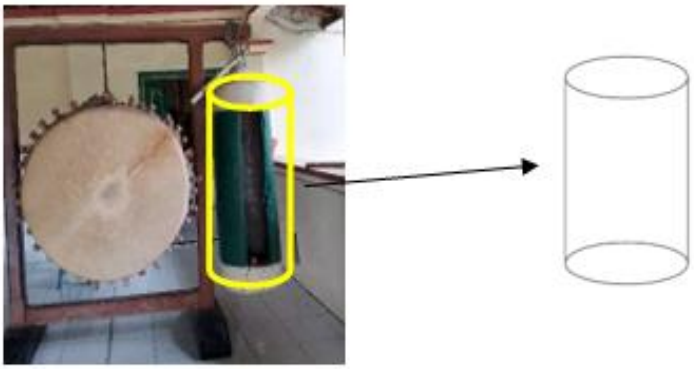

Figure 7. Mosque Horn

The Horn Jatisobo Great Mosque contains the concept of tubes that can be applied in the learning process of mathematics at school regarding the concept, properties and determining the area and perimeter of the tube.

❖ Geometry Transformation

In the design of the Jatisobo Great Mosque building there is the concept of geometric transformation in the form of a mosque mihrab, and the upper mosque pole. Here are some geometric transformations found in the design of the Jatisobo Great Mosque building:

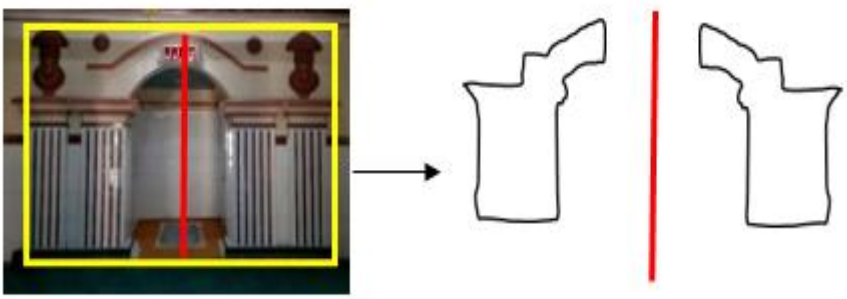

Figure 8. Mosque Mihrab

The mihrab of the Great Mosque of Jatisobo has the concept of reflection or mirroring that can be applied in the process of learning mathematics in schools regarding the concept of reflection (mirroring) to the y-axis. This can be seen from the shape of the left mihrab as the basic form reflected on the y-axis, creating the shape of the right mihrab.

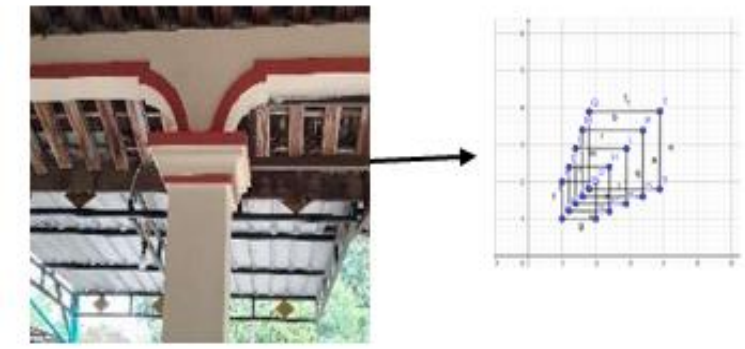

Figure 9. The Upper Mosque Pole

The Upper Mosque Pole at the Jatisobo Great Mosque has the concept of geometric transformation, namely dilation (multiplication). Where there is a change in size in a square building but does not change the shape of the square flat itself.

❖ Corner

In the design of the Jatisobo Great Mosque building, there is the concept of angles in the form of mosque support corners and mosque corners. The following angles are found in the design of the Jatisobo Great Mosque building:

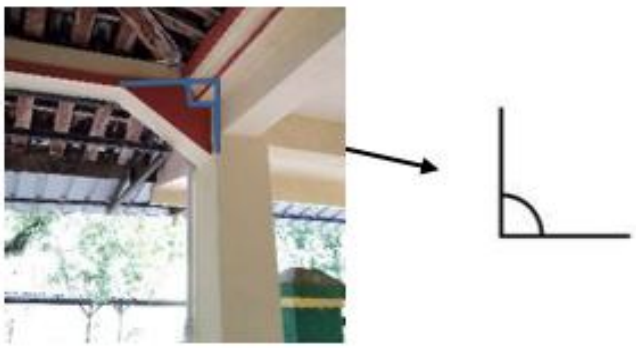

Figure 10. Mosque Support Corners

The corner supporting the Jatisobo Great Mosque has an angle concept that can be applied in the process of learning mathematics at school regarding the concept of angle material.

Based on the data above regarding the results of the analysis of ethnomathematics elements contained in the building design of the Jatisobo Great Mosque, it contains the concept of geometry in it. The existing geometry concepts include flat shapes, spatial shapes, the concept of angles and geometric transformations. The results of this analysis were also found in the Surakarta Great Mosque building (Asih et al., 2024), the holy tower (Rizky & Faizah, 2023) and the Jami 'Al-Baitul Amien Jember Mosque building (Yudianto et al., 2021). This is also explained by (Agustino & Susanto, 2024) research carried out on the introduction of local culture and the learning process, to be used as material for the development of mathematics learning in schools, in order to provide a cool, innovative and creative mathematics learning process so as to provide real and concrete knowledge and insight into the concepts of geometry that exist in the surrounding community.

CONCLUSION

According to the results and discussion as well as data analysis that has been carried out by researchers regarding ethnomathematics: geometry exploration in the building design of the Jatisobo Great Mosque, Sukoharjo Regency, it can be concluded that the Jatisobo Great Mosque Building Design not only shows cultural elements, but also shows the concept of geometry in several parts of the building design in the mosque. The geometry concepts found are square, rectangle, pyramid, prism, circle, tube, right angle, and geometry transformation. After obtaining the results of this research is expected to be a means of innovative and effective learning resources in learning mathematics. The author recommends the results of this research for the development of learning in schools, so that the process of learning mathematics can be done appropriately, not only sticking to modules and textbooks, but also can be implemented on local cultural heritage found in the surrounding community.

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