
Geometry concept on monument tugu malang city

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ABSTRACT

This study aims to identify the concept of geometry contained in the monument of Malang City. This research is a qualitative research with ethnographic approach. Data collection techniques used were observation and literature study. This study concluded that the Malang City monument has mathematical concepts that can be applied in learning activities, namely the concept of flat and spatial shapes.

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1. INTRODUCTION

These educational learning standards are used by the government as a reference in evaluating educators, educational institutions in carrying out assessments of student learning outcomes in schools (Kusainun, 2020). Mathematics learning standards based on Permendiknas No. 23 of 2006, do not focus on student understanding in learning activities alone (Cahyani, 2016). Mathematics learning process standards consist of 5 stages such as understanding mathematical concepts, mathematical reasoning, mathematical communication, mathematical connections and mathematical problem solving (Nasution, 2008). So with so many standards of achievement in the mathematics learning process, it requires some help or concept development from various aspects that students can use to develop the ability to understand the concept.

Mathematics learning is one of the subjects that emphasizes understanding concepts and applying logic (Astriandini & Kristanto, 2021). One of the various learning materials is geometry material (Hada et al., 2021). Geometry is a material that presents knowledge related to shapes and shapes in a dimension. In this case, the ability to analyze geometry concepts is included in one of the spatial abilities. In addition, geometry material is one of the important materials in learning mathematics. This is supported by a variety of contexts in human life that are always related to geometry.

Based on Puspendiknas data sources on the 2019 national exam, data obtained that students' test scores on geometry material standings are the lowest (Sari & Roesdiana, 2019). In addition, data obtained that students' difficulties in solving geometry problems are in the aspects of using concepts, using principles and solving verbal problems (Fauzi & Arisetyawan, 2020). and based on NCTM, concept understanding is the most important aspect in learning mathematics because understanding concepts will make it easier for students to master several other mathematical abilities such as problem solving skills (Radiusman, 2015). so it can be concluded that the main

problem that must be resolved in learning mathematics geometry material is concept understanding.

The importance of understanding mathematical concepts has been formulated by the National Council of Teachers (NCTM) and the 2013 Curriculum, which is a very important ability for students to have in learning mathematics, understanding mathematical concepts as the key to successful learning (Mulianty et al., 2018). Where by having the ability to understand mathematical concepts well, it will make it easier for students to solve a given problem. Because understanding concepts is the key to understanding principles and theories, especially if students want to master mathematics, especially higher-level thinking skills.

The ability to understand concepts is very important to determine student learning outcomes in learning mathematics. In line with research conducted by Effendi (2017), student learning outcomes in mathematics learning are strongly influenced by their ability to understand concepts by meeting their indicators. Jusniani (2018) says that the standard for someone to be said to be able to understand a concept is if he has been able to construct understanding in his own language, not just memorizing but also being able to distinguish and classify objects in examples and not examples and can find and explain the relationship of a concept with other concepts that have been given first. Therefore, it can be said that understanding of mathematical concepts must be improved because it is an important component in achieving learning objectives and improving student achievement.

Learning concept understanding by integrating cultural values is needed in the era of globalization because the use of local culture integrated learning can create mathematics learning that is closer to students so that it can be said to be more meaningful. Learning with contextual concepts of local culture is one form of teacher innovation in teaching the presentation of mathematical concepts related to local cultural contextual problem issues (Tandiseru, 2015). mathematics learning is one of the effective learning subjects in the men

Culture contains human works, such as knowledge, arts, laws, beliefs, and so on (Fajarisman et al., 2021). Indonesia is a country that has a variety of cultures because of the diverse mindsets and habits of the people, so there is also a lot of cultural diversity found here. Starting from dances, languages, traditional houses, clothes, and so on that show the characteristics of the local area (Misbahul Munir, 2021). so that the Indonesian state has a great opportunity in utilizing culture as an aspect of improving mathematics learning in schools.

Malang is one of the cities in the province of East Java, Indonesia (Anam, 2017). As an area that has a high population density, Malang City has characteristics that are well known in other parts of Indonesia. One of them is the Tugu monument which is the icon of Malang city itself (Nabila & Kurniawan, 2021). Seeing from its unique architectural design, therefore researchers are interested in conducting a study of the results of exploration of the Tugu monument in Malang in terms of its geometric concept. It aims to explain the concepts of geometry found in the Tugu monument of Malang City.



Figure 1. Tugu Kota Malang

2. METHOD

This research uses descriptive qualitative methods to explain the description of existing data on the Tugu monument in Malang city which will be presented in the form of descriptions of words. While the approach, this research uses an ethnographic approach, namely research with the aim of exploring socio-cultural contexts through field observations of the object of research. Field observation, documentation, and literature study research were conducted to collect data for the discussion. To validate the data collected in this study, researchers used triangulation. The type of triangulation used is data source triangulation. The research instrument is an observation guideline which acts as a benchmark for data collection during the data collection process. Data analysis in this study, researchers conducted several stages, namely data presentation, data reduction and conclusion drawing.

3. RESULTS AND DISCUSSION

3.1 The concept of geometry on the poor monument

Geometry is one of the scientific branches in mathematics that studies about points, spaces, lines and their various properties and characteristics (Musriroh et al., 2021). as one form of implication of geometry in real life, Malang city monument contains several geometry concepts found by researchers through observation. Malang city monument is the first independence monument built in Indonesia in. The construction of the Malang City Monument monument signifies that previously the Dutch administrative center has now been fully under the control of the Republic of Indonesia.

3.1.1 Flat Buildings

Flat shapes are shapes that have area and perimeter (Wulandari, 2017). There are various kinds of flat shapes that need to be studied, namely squares, rectangles, circles and so on. each flat shape has a side and area that can be calculated. The concept of flat shapes on the Malang city monument is as follows:

3.1.1.1 Rectangle

A rectangle is a quadrilateral flat shape that has 2 pairs of parallel sides and the intersecting sides create a 90° angle (Nuryami & Apriosa, 2024). The concept of rectangle is found in the paintings and carvings depicted on the monument, which are as follows:



Figure 2. Lukisan di Tugu kota Malang

In this painting, we know that there is a concept of flat buildings, namely rectangles. We can model the painting on the Malang city monument as follows:



The characteristics of flat shapes are as follows:

- i. The opposite sides are parallel and equal in length

In the painting of the Malang city monument, researchers have examined the Malang city monument. And it was found that the length of $AB = DC$ while the length of $BC = AD$

- ii. Each angle is equal to 90°

Based on the painting, the researcher knows that $\angle A = \angle B = \angle C = \angle D = 90^{\circ}$ (*Right – angled*)

- iii. The diagonals are equal in length

The diagonals in the painting of the Malang city monument are $AC = BD$

- iv. Every intersecting line is perpendicular to each other

The line in the painting of the Malang city monument form a perpendicular line, $AB \perp BC \perp CD \perp DA \perp AB$.

The historical value found in this painting is the meaning that this Malang city monument is a form of appreciation given to heroes in achieving freedom from the Dutch. Therefore this painting is carved and placed

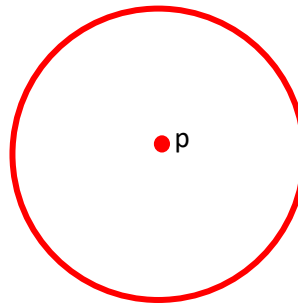
3.1.1.2 Lingkaran

A circle is a flat shape whose position or set of points is equidistant to a certain point (Soedyarto & Maryanto, 2008). The concept of a circle is found in the fence that closes the entrance to the Malang city monument.



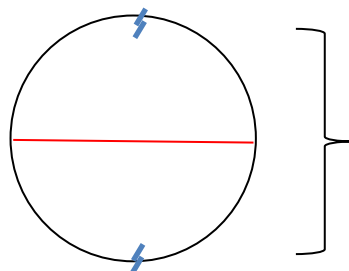
Figure 3. Gerbang pagar Tugu kota Malang

On this fence, we can model the circle in the following form:



The characteristics of a circle are as follows :

- i. Has an angle of 180^0
In the building of the Malang city monument, researches found that the related fence has a plane that has an angle of 180^0 and is perfectly round.
- ii. The diameter divides the building into equal sides
If a straight line is drawn at the center point, it will be found that the circle on the Malang city monument building divides the two fields equally.



Sisi atas dan bawah lingkaran memiliki besar yang sama

- iii. The radius connects the center point and the arc point
- iv. Has infinite rotary symmetry

3.1.2 Building space

Spacebuilding is a type of regular space object that has ribs, sides and corner points (Subagyo et al., 2015). There are several spatial shapes that can be studied, including cubes, blocks, pyramids, prisms, tubes. Each space has its own characteristics. When viewed from the Malang city monument, there are several forms of spatial shapes that can be studied. The shapes include the following:

3.1.2.1 Tube

The tube is a space bounded by two congruent and parallel sides in the form of a circle and a curved side, the base plane and the top plane of the circle with the same radius, the height of the tube is the distance between the center point of the base circle and the center point of the top circle (Wulandari & Anugrahen, 2021)

The concept of the tube in the Malang monument is as follows:

3.1.2.1.1 The center of the monument

The center of the Malang monument is shaped like a tube decorated with several philosophically meaningful painting components. Among them are paintings of 5 major islands in Indonesia, pictures of palms, pictures of proclamation texts, pictures of heroes, Pancasila and pictures of rhinos. Each painting in the center of this unfortunate monument signifies a separate meaning. The relief of the proclamation text signifies the independence of the Indonesian republic from the Netherlands, then the relief of the 5 major Indonesian islands signifies the integrity of the Indonesian state, the pancasila relief signifies the basic ideology of pancasila used by Indonesia, the relief of heroes and several other reliefs are also intended as something that the Indonesian state is proud of and should not be disturbed at all by any party.



Figure 4. Bagian Tengah Tugu kota Malang

3.1.2.1.2 Pointed Bamboo



Figure 5. Puncak Tugu kota Malang

The pointed bamboo replica symbolizes the form of the Indonesian people's struggle with the first weapon, namely pointed bamboo, against Dutch colonialism in an effort to seize independence. Pointed bamboo also symbolizes the spirit of courage of the Indonesian people from the spirit of revolution.

The tube shape on the Malang City monument can be represented in the following form:

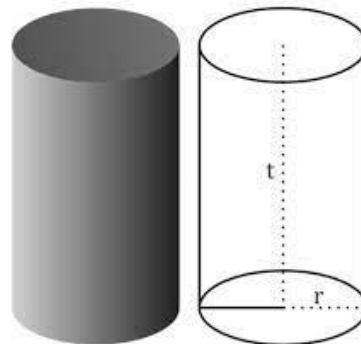


Figure 6. Replika tabung

The characteristics of the tube are as follows:

- (a) (The base and top sides of the tube are circular
- (b) The curved side that envelops the tube, which when stretched out will be rectangular in shape
- (c) t as the height of the tube which is the distance from the center point of the upper and lower circles
- (d) Has the same r (radius) of the top and base circles

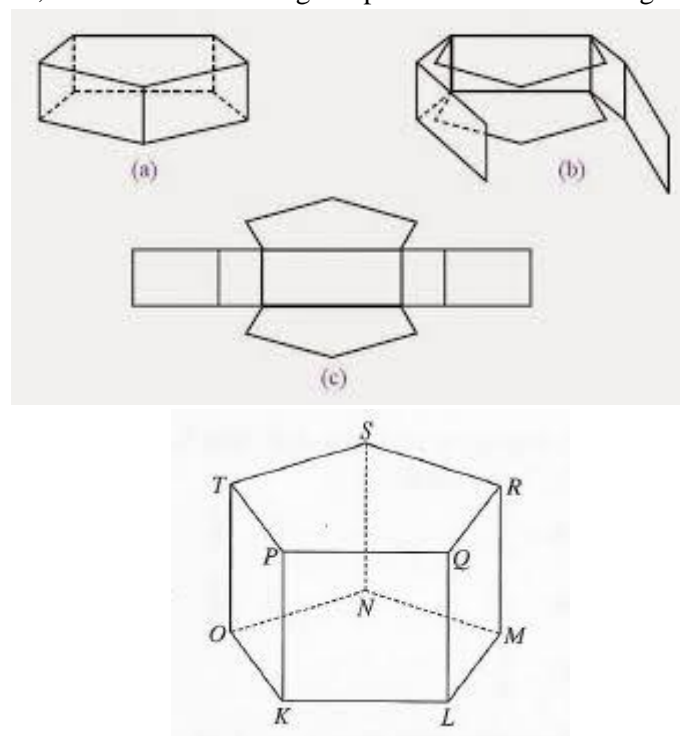
3.1.2.2 Triangular prism

A prism is a space bounded by two parallel planes and other planes that intersect according to parallel lines (Suharjana, 2008). There are various types of prisms, according to the flat shapes that make up them. There are triangular, quadrilateral, triangular prisms, and many more. Meanwhile, the researchers found the concept of a triangular prism in the padma component of the Malang city monument. Padma is a kind of typical Indonesian building structure such as a temple that resembles the shape of a lotus flower. For more details, please see Figure 6 below:



Figure 7. Dasar tugu Kota Malang

On the Malang monument, we can model a triangular prism with the following image,



The researcher found a triangular prism that stacked several parts. There are several characteristics of the rectangular prism found, namely:

- (a) It has 2 pentagon shaped sides and 5 rectangular shaped sides
- (b) It has 15 ribs. (RS, ST, TP, PQ, QR, MN, NO, OK, KL, PK, QL, RM, SN, TO).
- (c) It has 10 corner points ($\sphericalangle P, \sphericalangle Q, \sphericalangle R, \sphericalangle S, \sphericalangle T, \sphericalangle K, \sphericalangle L, \sphericalangle M, \sphericalangle N, \sphericalangle O$).

4. CONCLUSION

Based on the results of this study, it can be concluded that

1. There is a concept of geometry in the Malang City Tugu building, namely the geometry of flat and spatial shapes.
2. The concept of flat buildings contained in the Malang City Monument is a rectangle and a circle.
3. The concept of space contained in the Malang city monument is a tube and a five prism.

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