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Ethnomathematics on the Thomas Parr Monument of Bengkulu

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ABSTRACT

This research aims to identify mathematical objects in the building of Tugu Thomas Parr Bengkulu. The Thomas Parr Monument area is located on the coast of Bengkulu City. This research is descriptive qualitative research using an ethnographic approach. Data collection was done through observation, interview, and documentation. Data analysis techniques are done by collecting, reducing, presenting, and drawing conclusions. This research shows that the shapes of the Thomas Parr Monument Bengkulu building have mathematical concepts, including half circle, half sphere, rectangle, tube, congruence, and parallel lines. These results positively impact mathematics education because they can be used as a contextual learning medium through colonial heritage objects. Thus, the mathematical concepts in the Thomas Parr Bengkulu Monument can be used to introduce and understand geometric concepts through colonial heritage so that learning becomes more relevant, which can then be developed into teaching materials such as modules, LKPD, etc.

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1. INTRODUCTION

Education is part of preserving culture, and culture is important to be applied to learning in education. One type of learning that is seen as having the potential to improve culture-based learning is mathematics [1]. Mathematics is still considered a difficult subject that only consists of a set of formulas that do not depend on the actual circumstances of students [2]. Culture and mathematics are interrelated because both are used in everyday life [3]. Integrating culture into mathematics learning provides opportunities to create more engaging and contextualized learning experiences. Culture can be used as a source of learning for students, especially in mathematics at school, which is expected to make learning more creative and shape students' mindsets to understand problems [4]. One of the bridges between education and culture, especially mathematics, is ethnomathematics [5], [6].

Ethnomathematics was first introduced by a mathematician from Brazil, D'Ambrosio (1985), who revealed that ethnomathematics is the impact of mathematical activities that are influenced by activities in the community in their environment due to the impact of culture. This concept emphasizes the connection between mathematical knowledge and a society's cultural practices. Ethnomathematics is a bridge between education and culture that can provide knowledge with values that students can understand because it is related to habits that can be integrated with the traditions and habits around them in learning mathematics [7], [8].

Using ethnomathematics in mathematics learning makes learning more meaningful [9]. The purpose of studying ethnomathematics is to understand the relationship between mathematics and culture so that the perceptions of students and society about mathematics become more precise and easy to understand, as well as utilize culture, including ways of thinking, working, behaving, and speaking, especially those related to mathematics [10]. Ethnomathematics can be formed from the characteristics as a marker of an area and its culture, seen in historical buildings, regional specialties, tourist attractions, and socio-cultural activities [11]. This approach helps students grasp mathematical concepts and fosters cultural appreciation and critical thinking. Therefore, ethnomathematics can be a learning resource for students who can build creativity in solving problems, especially in mathematics [4].

Bengkulu culture can be seen in terms of historical buildings; one of the historical buildings in Bengkulu is the Thomas Parr Monument. Monuments that are built usually show the historical or cultural value of a particular region. In Indonesia, some monuments are built to commemorate the services of heroes, and some are built to commemorate an event [12]. Such monuments serve as tangible links between history, culture, and education.

This Thomas Parr monument is called the Bulek Grave by the people of Bengkulu. The British erected this monument as a tribute and honor to Thomas Parr, while for the people of Bengkulu, it was interpreted as a tribute to the unknown warriors who had died fighting and defending the rights and independence of their ancestral lands from British colonial oppression [13]. This dual interpretation of the monument reflects the complex historical and cultural interactions between colonial powers and local communities.

The Thomas Parr Monument in Bengkulu has unique characteristics that are interesting to study. In addition to integrating mathematical concepts such as geometry and pattern, which are relevant for education, the architectural design reflects the British colonial style with symmetrical pillars and monumental geometric structures [14]. This monument, built in 1807 in memory of murdered British Resident Thomas Parr, has significant historical value [15]. It became a symbol of British colonial power in the archipelago. This monument is a historic icon of the city because it is in the center of Bengkulu City and is easily accessible to people and tourists. This monument also shows the interaction of local and international cultures. By studying this monument, students can explore how historical architecture embeds mathematical principles, making learning more contextual and interdisciplinary. The Thomas Parr Monument has many different aspects. Apart from being a historical relic, it is also a source of inspiration for education, research, and the preservation of cultural values.

Several ethnomathematics studies have investigated architecture, ornaments, specialties, and cultural buildings in some areas of Indonesia. The study of ethnomathematics in Dutch colonial heritage is found in the Pekalongan Arch Bridge. The concept of ethnomathematics on the Pekalongan Arch Bridge is related to the concepts of congruence, surface area, volume, line, and angle patterns found in the bridge structure [16]. Studies exploring ethnomathematics geometry in Tugu Jogja show the concept of geometry (space) in the building [17]. Ethnomathematics studies that aim to find mathematical elements in the Tugu Kebuletan Tekad monument show that there are geometry concepts (flat shapes) that can be used as an alternative source of mathematics learning [4]. Previous research on ethnomathematics supports research on the Thomas Parr monument in Bengkulu by showing how mathematical concepts can be found. Previous research on ethnomathematics has shown that cultural heritage, such as monuments, monuments, and traditional artifacts, contains mathematical values that can be interpreted in the context of geometry, symmetry, and others. These studies underscore the value of cultural heritage as a rich resource for mathematics education.

Ethnomathematics in this study will examine the mathematical concepts of the Thomas Parr monument building in Bengkulu. Tugu Thomas Parr Bengkulu is a colonial heritage from England. This research aims to identify mathematical concepts contained in the building of Tugu Thomas Parr Bengkulu. This study aims to demonstrate how mathematical principles are embedded in cultural artifacts, offering insights into their educational potential and cultural significance.

2. METHOD

The method used in this research is descriptive qualitative research. The approach used is ethnography. Ethnography is a comprehensive study of the behavior of a particular social or cultural group [18]. This approach allows researchers to deeply explore the cultural aspects and their integration with mathematical concepts. Data collection techniques involve making observations or field observations, taking documentation, and conducting interviews [19]. Observations were made by visiting the research site on Jalan Ahmad Yani, Teluk Segara Sub-district, Bengkulu City. Documentation involves photos that can provide information about the mathematical concepts found on the Thomas Parr Monument Bengkulu. These photos serve as visual evidence supporting the identification of ethnomathematical elements. This interview was conducted with a Bengkulu culturalist who aims to get more in-depth information about ethnomathematics at the Thomas Parr Monument Bengkulu.

Data analysis techniques are carried out by collecting, reducing, presenting, and drawing conclusions. This systematic process ensures the validity and reliability of the research findings. Data collection techniques are the methods researchers use to record the required data (information) [20]. Data reduction is an analysis that sharpens, classifies, and removes what is unnecessary [21]. The data reduction carried out was to classify the mathematical forms at the Thomas Parr Bengkulu Monument. This classification process highlights specific mathematical patterns and structures in the monument's design. The presentation of data or information is the function of preparing a research report, carried out

so that it is possible to analyze and understand it according to the desired objectives [21]. The data presentation is in the form of documentation results regarding mathematical concepts in the Thomas Parr Bengkulu Monument. These documented findings provide a clear framework for understanding the ethnomathematical significance of the monument. Concluding results from the final data reduction and presentation process will produce conclusions, which will be obtained from the research results regarding what mathematical concepts are contained in the Thomas Parr Monument Bengkulu. This step synthesizes all the analyzed data into coherent insights that connect mathematics with cultural heritage.

3. RESULTS AND DISCUSSION

3.1. Results

The Thomas Parr monument aims to commemorate the death of Thomas Parr (Thomas Stamford Raffles), the British resident who died in 1807. The construction of this monument was carried out exactly one year after his death. This monument is called Kuburan Bulek by the people of Bengkulu. The British erected this monument as a tribute and honor to Thomas Parr, while for the people of Bengkulu, it is interpreted as a tribute to the unknown warriors who have died fighting and defending the rights and independence of their ancestral lands from British colonial oppression [13].

The mathematical concepts contained in the Thomas Parr monument can be utilized to introduce and understand the concept of geometry through local culture. Geometry is a field of mathematics that studies objects' shape, size, relative position, and spatial properties. Geometry discusses the relationship between points, lines, planes, and flat and spatial shapes [22]. Geometry is used to understand and solve problems related to size, position, distance, angle, volume, and other visual aspects in everyday life [23]. Geometry uses multiples to create various spatial shapes such as triangles, circles, squares, rectangles, parallelograms, spheres, cones, prisms, and so on [24].

Ethnomathematics includes mathematical knowledge developed by cultural communities through grouping, counting, measuring, designing buildings and tools, playing, and more. In ethnomathematics, basic mathematical activities include counting (counting/numbering), measuring (measuring), searching (finding), designing (making), playing (playing), and explaining [25]. Ethnomathematics aims to show the existence of various kinds of mathematics. The Thomas Parr Monument building is an example of architecture with mathematical concepts that must be learned. Some parts of the structure can be used to introduce various mathematical concepts.

a. Dome of the Monument

Figure 1. Dome of the Monument

Researcher: *Why is this Thomas Parr monument called Kuburan Bulek by the people of Bengkulu, sir?*

Respondent: *Because the dome is round.*

Researcher: *How do we know it is round, sir?*

Respondent: *Besides, we can see directly that it is round and measured. The shape is like a ball, but only half, not whole.*

Researcher: *How do you measure it, sir?*

Respondent: *This is when I did the study and history for the renovation of this monument. We measured the base using a rapiah rope that surrounds the dome. Then, from the rapiah rope, we use a meter to know how much the size is, while for the diameter inside, the size, while for the diameter inside, we use a laser.*

Researcher: *How to use the laser, sir?*

Respondent: *We center the laser point on the edge (point A in Figure 1), and then the center (point B) will also tell us how much the size is.*

Based on the data analysis of the interview excerpts above, it is obtained that in the process of making the Thomas Parr Monument Bengkulu, there is a hemispherical concept and mathematical activity in the form of measuring.

b. The Monument Door

Figure 2. The Monument Door

Researcher: *Well, what about the door?*

Respondent: *The door is rectangular but not full up to the top; the top is curved like a circle but not wholly the same as the ball, only half of it.*

Researcher: *How do you know that it is rectangular and semicircular, sir?*

Respondent: *The size of the top and bottom are the same length if the side is longer than the top and bottom. What would it be like if the sides were the same length and the top and bottom were the same?*

Researcher: *Square, sir?*

Respondent: *Well, that is right.*

Researcher: *What about the semicircle?*

Respondent: *The bottom is the same as the top of the rectangle earlier; the length is like a straight line. This straight line has a center point that divides the straight line. Then, we set the center point to pull the rapiah rope curved upwards to form a semicircle.*

Based on the data analysis of the interview excerpts above, it is obtained that in making the Thomas Parr Monument in Bengkulu, there are concepts of rectangles and semicircles and mathematical activities in measuring and designing.

c. Monument Pole

Figure 3. Monument Pole

Researcher: *What about the pole, sir?*

Respondent: *The pole is the same top and bottom shape as the round shape, and then this distance between the top and bottom is the distance between the poles.*

Researcher: *There are two of these. Are they the same size, sir?*

Respondent: *Yes, they are all the same size and the same height.*

Based on the data analysis of the interview excerpts above, it is obtained that in making the Thomas Parr Monument Bengkulu, there are concepts of congruence and tube space, as well as mathematical activities in measuring.

d. The Monument Stairs

Figure 4. The Monument Stairs

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Respondent: *The ladder count must always be odd.*

Researcher: *Why does it have to be odd, sir?*

Respondent: *Do you know what indis culture is in Dutch?*

Researcher: *No idea, sir.*

Respondent: *Indis is a mixture of Dutch and indigenous Javanese culture. So the level of stair calculation is "tingkek, tangga, tunggu, tinga," and we have to choose an odd calculation if not "tingkek" or "tunggu." In addition, if we look at the distance between stairs one and other stairs, it is the same even though the length of the two directions is different.*

Based on the data analysis of the interview excerpts above, parallel lines and mathematical activities, namely measuring and designing, are used to make the Thomas Parr Monument Bengkulu.

3.2. Discussion

a. Half Ball Concept

Figure 5. Half Ball Concept

This concept is found in the dome of the monument. The result of the respondent's interview is that it is round, like a ball, but not whole. A half ball is a three-dimensional space resulting from slicing a ball on its diametral plane, resulting in half of its shape [26]. Based on this, the researcher analyzes the half-sphere concept for the monument dome as follows:

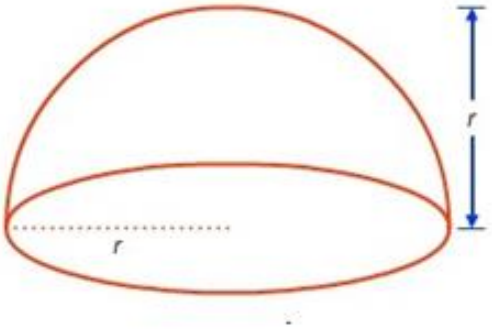

Figure 6. Half ball shape

A half ball is a portion of a whole ball cut into two equal pieces. A half-sphere is also a ball in the shape of a half. The half sphere has one center point inside, one side, namely the curved side, no corner points, and an infinite radius [27]. The monument dome has a diameter of 6 meters and a curved side of 2.5 meters. Therefore, the monument dome is a model of the mathematical concept of the shape of a hemispherical space.

b. Concept of Rectangle and Semicircle Concept

Figure 7. Concept of Rectangle and Semicircle Concept

- **Concept of Rectangle**

  This concept is found on the door of the monument. The results of the respondents' interviews show that the rectangle has a shorter width than the length of the rectangle. A rectangle is a rectangular flat shape with two sides facing parallel and the same length [28]. Based on this, researchers analyzed the concept of rectangles for monument doors as follows:

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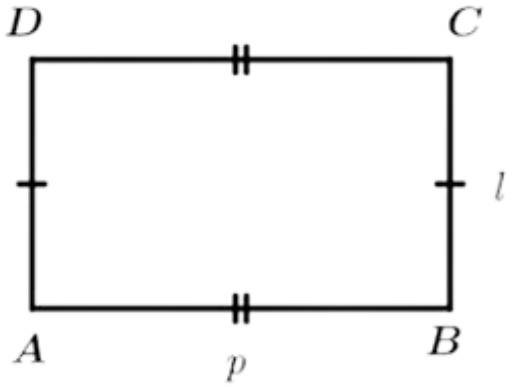

Figure 8. Concept of Rectangle

A rectangle is a plane figure with two parallel sides and four right angles. Rectangle ABCD has sides AB, BC, CD, and AD, and both parallel sides have the same length. So, side length AB = side length CD; side length BC = side length AD. The angles of rectangle ABCD are ∠ ABC, ∠ BCD, ∠ CDA, and ∠ DAB. Where ∠ ABC = ∠ BCD = ∠ CDA = ∠ DAB = 90°. The monument door is 100 cm long and 80 cm wide. Therefore, the monument door models the mathematical concept of a rectangular flat shape.

- **Semicircle Concept**

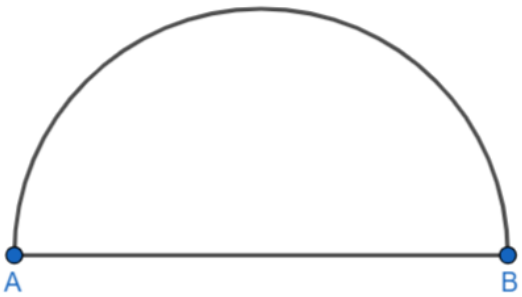

Figure 9. Semicircle Concept

This concept is also found on the door of the monument. The interview results with the respondents showed that the semicircle is categorized because it has two sides. One of the sides is perfectly flat and forms one straight line. The other side is a 180-degree curve, which is drawn at an equal distance from the center point of the straight-line side. It is on a straight line equal to the rectangle's width, which is 80 cm. Therefore, the upper monument door models the mathematical concept of a semicircular flat shape.

c. Concept of Congruence and Tube Concept

- **Concept of Congruence**

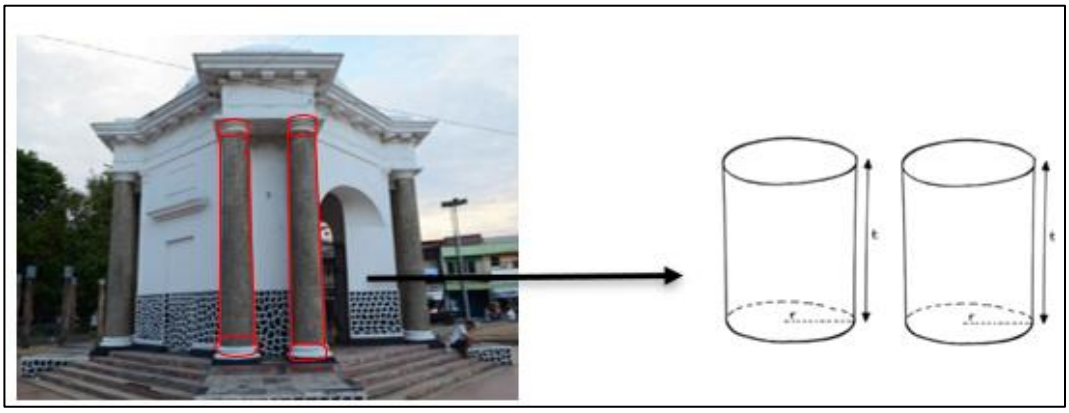

Figure 10. Monument Pillar

This concept is also found in the monument pole. The results of interviews with respondents show that the monument poles are congruent because two flat shapes are said to be congruent if all the corresponding sides have the same length and the corresponding angles have the same magnitude [29]. In this concept of congruence, there is a monument pole height of 4 meters on each monument pole. Therefore, the monument pole is modeling congruence.

- **Tube Concept**

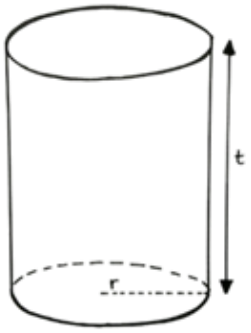

Figure 11. Tube

This concept is also found in the pillar part of the monument. The results of interviews with respondents show that a tube is a space bounded by a curved side and two congruent sides that are parallel in the form of a circle and a rectangle that surrounds the two circles [30]. In this tube concept, the curved side has a height of 4 meters, and the two congruent sides have a circle size of 80 cm. Therefore, the monument pole also represents a model of the tube space.

d. Concept of Parallel Lines

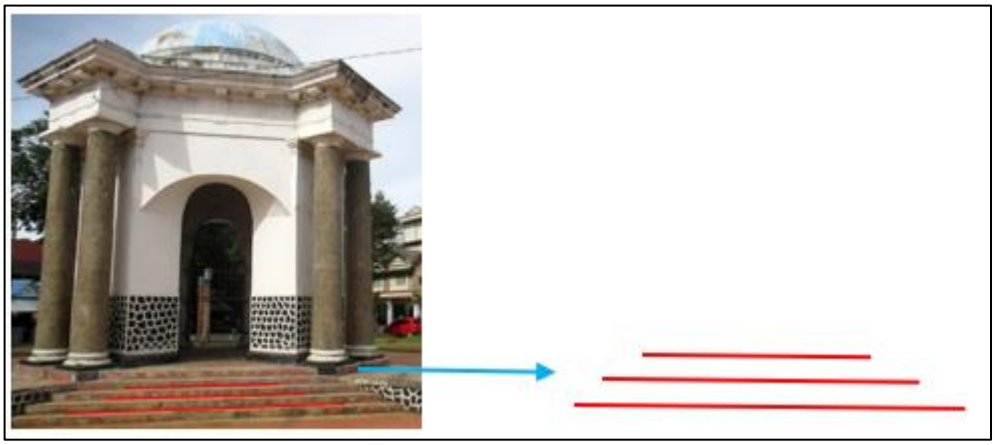

Figure 12. Parallel Lines

This concept is also found on the stairs of the monument. The results of interviews with respondents show that two or more lines on the same plane never intersect, even if extended indefinitely. Parallel lines have a distance that is always the same from each other [31]. In this monument, the stairs are the same distance, 13 cm, on each step. Therefore, the monument stairs are also modeling the concept of parallel lines.

4. CONCLUSION

This research shows that the ethnomathematics of the Thomas Parr Monument in Bengkulu can significantly contribute to understanding local culture through a mathematical perspective. There are mathematical concepts in this Thomas Parr monument building: 1.) The concept of half a sphere on the monument's dome, 2.) Rectangular concept and semicircular concept on the monument door, 3.) The concept of congruence and tube space on the monument pole, 4.) The concept of parallel lines on the monument's stairs and mathematical activities in measuring and designing are also included. Thus, the mathematical concepts on the Thomas Parr Monument can be further developed as teaching materials in the form of understanding mathematical concepts in mathematics learning. This opens up opportunities to integrate cultural elements in mathematics learning to strengthen the relevance of learning to local contexts and preserve cultural heritage. Apart from that, these findings can be a reference in developing an ethnomathematics-based curriculum, especially in the Bengkulu area and surrounding areas, to increase students' appreciation of history and cultural values.

However, several limitations need to be considered. One of them is that for future research, it is recommended to involve more involvement from the local community, including a multidisciplinary approach involving the fields of anthropology, history, and education, which can provide a more comprehensive insight into the role of ethnomathematics in preserving and teaching local culture. Further research could also

explore the potential for using ethnomathematics on monuments or other cultural sites in Indonesia, thereby expanding its contribution to education and cultural preservation.

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