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Ethnomathematics Exploration of Museum Gedung Arca (State Museum of North Sumatra)

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ABSTRACT

Education and culture are two things that cannot be separated. In education, there are cultural values in it. Ethnomathematics is a blend of mathematics and culture. Ethnomathematics can improve students' mathematical abilities. By exploring the ethnomathematics of the Arca Building Museum or the State Museum of North Sumatra, students can get to know the culture and geometric concepts of flat shapes found in building forms and museum collections. The geometry of a flat shape is a form of geometry that has an area and a width. The research aims to improve students' mathematics learning and mathematical abilities through geometric exploration of flat shapes in building shapes, collections, and collection placement in museums. The method I used in my research was qualitative research. The results of the research obtained are finding the geometric concept of flat shapes through the shape of the building, the collection, and the placement of the Museum collection. Ethnomathematics exploration is an alternative to improve mathematics learning and students' mathematical abilities. By exploring the concept of geometric shapes in the form of museum buildings, students can easily understand the mathematics of geometric shapes.
Keywords : Ethnomathematics, Sculpture Building Museum, Flat Shape Geometry

ABSTRAK

Pendidikan dan budaya merupakan dua hal yang tidak dapat dipisahkan. Dalam pendidikan terdapat nilai-nilai budaya didalamnya. Etnomatematika adalah perpaduan antara matematika dan budaya. Etnomatematika dapat meningkatkan kemampuan matematis siswa. Dengan eksplorasi etnomatematika Museum Gedung Arca atau Museum Negeri Sumatera Utara siswa dapat mengenal budaya dan konsep geometri bangun datar yang terdapat pada bentuk bangunan dan koleksi museum. Geometri bentuk bangun datar merupakan suatu bangun dari geometri mempunyai ukuran luas dan lebar. Tujuan penelitian meningkatkan pembelajaran matematika dan kemampuan matematis siswa melalui eksplorasi geometri bentuk bangun datar pada bentuk bangunan, koleksi, dan penempatan koleksi di Museum. Metode penelitian ini adalah penelitian kualitatif. Adapun hasil penelitian yang di peroleh yaitu menemukan konsep geometri bentuk bangun datar melalui bentuk bangunan, koleksinya, dan penempatan koleksi Museum. Eksplorasi etnomatematika adalah salah satu alternative untuk meningkatkan pembelajaran matematika dan kemampuan matematis siswa. Dengan mengeksplor konsep geometri bangun datar pada bentuk bangunan museum maka para siswa mudah memahami matematika geometri bangun datar.
Kata Kunci : Etnomatematika, Museum Gedung Arca, Geometri Bangun Datar.

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PRELIMINARY

According to (Sulistyani, 2019) Culture is an activity or activities carried out by the community continuously from year to year and as a symbol or characteristic of the area where they live. The cultural points that can foster the formation of a citizen's personality include religious points, intelligence points, societal points, and points in the nation and state. Education is an obligation for mankind to continue learning while still alive and is very important in living a social life. In education, the contents of cultural points are included in which these cultural points are used as the formation of the personality of citizens.

According to (Aflah, 2022) Culture and education are likened to a coin, meaning that education and culture are related or related to each other and cannot be distinguished in daily activities. To foster the formation of the personality of citizens in students, namely with mathematics education.

According to (Pulungan, 2022) Mathematics is a vehicle for increasing the ability to think in a real, structured, and thorough way. According to (Hannia Luthfi, 2022) The purpose of mathematics is to improve students' decision-making abilities and views that students can solve problems encountered in students daily activities.

According to (Nomleni, 2022) Mathematics and culture can be related to one another. Mathematics with culture is known as ethnomathematics. Ethnomathematics is the act of applying mathematical values to the cultural elements of a group of people. According to (Harahap, 2022) The Beginnings of Ethnomathematics was published by a popular individual mathematician in 1985 named D'Ambrosio from Brazil. According to (Jhenny Windya Pratiwi, 2020) The purpose of ethnomathematics is to participate in reviewing various methods of solving mathematics by taking into account mathematical knowledge that is translated from various areas of society. In addition, ethnomathematics aims to analyze how students interpret, formulate, and abstract and later students will apply mathematical concepts and apply these concepts.

According to (Safitri, 2021) Learning mathematics is an item of education that functions to improve students' assuming ways of dealing with a problem and to practice preparing these assumptions for the future of students. In learning mathematics, there are points to foster positive behavior in students, such as never giving up, and being innovative, consistent, logical, rational, and thorough. According to (Yuni Kartika, 2022) The goal of learning mathematics is to direct students to think logically or logically to solve a mathematical problem or problem by proving the answer scientifically and also

structured. Mathematics learning is declared successful when students' learning outcomes get maximum results.

According to (Lisnani, 2020) Geometry is a mathematical science that is somewhat difficult for students to understand the concept. According to (Fajari, 2020) Geometry is a presentation of general material that discusses size, area, and width and supplies students with the ability to imagine the subject. Plane geometry is a geometric shape that has a flat surface, only has two dimensions, and only has an area. Examples of flat geometric shapes are triangles, rhombuses, kites, trapeziums, squares, rectangles, parallelograms, and circles. According to (Yunni Arnidha, 2022) The problem in encountering math lessons is in the geometric elements of plane shapes, and most students are unsure about choosing shapes from the geometry of plane shapes.

The mathematical ability of students is still relatively low because many students are less able to apply mathematical theory to their daily lives. The students only memorized the theories or mathematical formulas contained in their mathematics manuals and the theories conveyed by the teacher based on the contents of the student mathematics manuals. Students are only based on theory or mathematical formulas so when given a problem that is not in the student manual, it can be seen that they have difficulty solving the problems or problems given to them.

According to (Inayah Rizki Khaesarani, 2022) The mathematical theory taught by teachers is still low or lacks insight and knowledge possessed by teachers regarding mathematical theories that will be conveyed to students, teachers do not prepare and study the material that will be conveyed to students, the teacher does not apply or give examples of the material studied in the daily life of students and the learning approach method or style in learning mathematics used by the teacher cannot attract students to participate in learning or the method used by the teacher is boring, as a result, students face difficulties to solve shared problems. According to (Dalimunthe, 2022) Finally, educators must determine various styles in mathematics lessons so that students take seriously the lessons that take place in the classroom and don't get bored. According to (Sari, 2022) Mathematics learning resources are the most important thing in the process of learning mathematics which can focus students on understanding part of the material to solve math problems. The effort to solve this problem is to change the students' mathematics learning approach strategy. According to (Sawita, 2022) The learning approach is all the teacher's action efforts to determine lesson action efforts.

The strategies that can be carried out in the learning process are to attract the attention of students to participate in the learning process so that learning is interesting and fun for students, namely the teacher carries out mathematics learning by linking mathematics with culture towards mathematics learning material for students. According to (Adella Irma Wiyanti, Dyah Ayu Wulandari, Febbyana Ilwan Kajori, Salsabilla Indah Alfiani, Wahidin, 2022) With this strategy, students can easily understand the mathematical material because they see directly the objects of the mathematical material they are studying. The approach strategy taken to link mathematics with culture is known as ethnomathematics. According to (Hutauruk, 2020) That way, students are expected to be able to solve difficult problems that occur in student's daily activities related to mathematics, and learning mathematics can be declared successful and get maximum results.

Tourist attractions that can introduce the culture and can be used as a means of studying ethnomathematics are the Arca Building Museum (North Sumatra State Museum). The cultural points that can be reviewed are the shape of the statue building museum building and also the collection of various collections contained in the statue building museum. At the Gedung Arca Museum, the shape of the building and its collections apply mathematics in the field of geometry, namely to be more precise on flat material. The following are the objectives of this research, namely, among others:

1. Can optimize learning mathematics.
2. Optimizing the mathematical abilities of students, especially in the field of flat-shape geometry.
3. Optimizing the flat shape found in the building of the statue building museum (state museum of north Sumatra).

The researcher hopes that this research will be useful for educators and students and can help students understand the field of geometry in the concept of flat shapes and improve students' mathematical abilities.

METHODS

The research method used by researchers is descriptive qualitative research. The location of this research was carried out at the Arca Building Museum (North Sumatra State Museum) which is located on road H.M. Joni No. 51, Medan Kota District, Medan City, North Sumatra. The subject of this study is the shape of the Arca Building Museum building, its collections, and the place to place the museum’s collections. The Geometry

concepts in flat shapes are described based on those contained in the Arca Building Museum (North Sumatra State Museum). The informer in the study was one of the administrators of the statue-building museum (North Sumatra State Museum). This research was conducted on December 21, 2022, at 08.00 WIB in the morning. Researchers collected data using research instruments in the form of observations, interviews, and documentation. Researchers conducted data analysis by reducing data, presenting data, and also drawing conclusions from the results of observations and interviews that had been conducted. Following are the steps taken in this research are as follows:

1. Researchers conducted observations and interviews at the Arca Building Museum (North Sumatra State Museum) with one of the museum's administrators who are related to the geometric theory of flat shapes.
2. The researcher reduced the data based on the results of observations that had been made of the shape of the buildings, collections, and placement of the museum's collections which are related to the geometric theory of flat shapes.
3. The researcher presents data based on the results of observations that have been made, namely in the form of pictures of the shape of buildings, collections, and the placement of the museum's collections related to the geometric theory of flat shapes.
4. After that, the researcher draws conclusions based on the results of observations and interviews that have been conducted

RESULTS AND DISCUSSION

The results of the research based on the exploration carried out in the Gedung Arca Museum building (North Sumatra State Museum) were carried out by observation and interviews. The advantage of this research is that there are many applications of flat geometric shapes in the shape of buildings, collections, and the placement of the museum's collections which can be seen in real-time and there is also a description of each of the collections exhibited in these perverts and it is easy for students to recognize and makes it easier for teachers to explain the theory of flat geometry to students. The weakness of this study is that there are no kites and parallelograms and the explanation of the theory is based on the results of observations and interviews that have been conducted at the State Museum of North Sumatra. The limitation of this research is that during the interview with one of the museum administrators, it was only conducted briefly because at that time all the museum administrators gathered for lunch and held a meeting.

The Arca Building Museum (North Sumatra State Museum) was appointed by the Minister of Education and Culture, Dr. Daoed Yoesoef as a Museum or one of the tourist attractions which has elements of education and culture in it on Monday, April 19, 1982. The North Sumatra State Museum is located at Jalan H.M.Joni No.51, Medan Kota District, Medan City, North Sumatra. The first collection placed in the Arca Building Museum was placed by President Soekarno in 1954. The first collection was placed by the first President of the Republic of Indonesia, namely Mr. Ir. Sukarno Makara. Makara is a mythical animal that has the head of an elephant and the tail of a fish that lives in the Ganges river. In general, Makara is represented in the form of statues and placed in pairs in front of the left and right cheeks of the stairs of the temple building. This Makara was found at the Sitopayan Monastery, North Padang Lawas Regency, and is thought to have originated from the 9th to 11th centuries AD. So from that first collection, the Museum was named the Arca Building Museum. The land area of the North Sumatra State Museum complex has an area of 10,468 m^2.

The design model for the main building of the Museum illustrates the shape of an ancient building typical of North Sumatra province. The front roof of the museum is formed from ornaments from various ethnic groups, especially those in North Sumatra Province. The Directorate General of Culture, Ministry of Education and Culture was part of the board that protected and looked after the State Museum of North Sumatra from 1982-1999. In 2000 the administrator who protected and looked after the North Sumatra State Museum after provincialism was enacted was the Provincial Government of North Sumatra. The Arca Building Museum building contains various rooms, including the lobby room, office, lighting or information room, prehistoric room, megalithic room, Hindu-Buddhist room, Islamic room, colonial room, North Sumatra struggle room, Governor's room, garden, toilet, audio room visual/speech room, museum headroom, permanent exhibition room, temporary exhibition room, guidance section room, computer room, library, microfilm room, and warehouse. Until 2005, the State Museum of North Sumatra kept a collection of approximately 6,799 collections.

Exploration is an act of investigation to obtain information from conditions that occur in a place and is also interpreted as an act to gain new knowledge. Ethnomathematics is the science of mathematics applied to cultural groups identified in various groups, such as groups of children of a certain age, as well as with children from the professional class. According to (Asmara, 2019) the Museum is an absolute institution, has the aim of serving the community, exhibiting learning or educational activities, and functioning as a place of

preservation. Plane geometry is a representative of mathematics to analyze a geometric shape that only has two dimensions, has an area, and has no volume.

Based on the results of the exploration of the statue building museum (North Sumatra State Museum), there are various geometrical concepts of flat shapes, both in terms of the shape of the building, the placement of the museum collections, and the shape of the museum collections. A flat shape is a shape that only has a circumference and area and has no volume. According to (S, 2017) There are various kinds of flat shapes, including triangles, squares, rectangles, parallelograms, rhombuses, kites, trapeziums, and circles. The following are the results of observations and documentation of the shape of the building, collections, and placement of the collections of the Gedung Arca Museum (North Sumatra State Museum).

Figure 1. Entrance and Exit Gates of the State Museum of North Sumatra

Figure 1 is the entrance and exit gates of the State Museum of North Sumatra. The top of the two pillars of the gate is shaped like a triangle.

Figure 2. Front of the State Museum of North Sumatra

Figure 2 is the front of the North Sumatra State Museum. The roof of the museum is like a gable roof, that is, the top of the house uses a very sharp, slanted elbow.

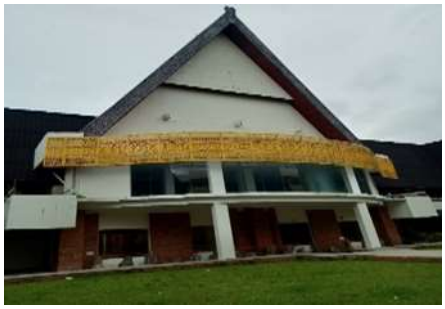

Figure 3. The back of the State Museum of North Sumatra

Figure 3 is the front of the North Sumatra State Museum. The roof of the museum is like a gable roof, that is, the top of the house uses a very sharp, slanted elbow.

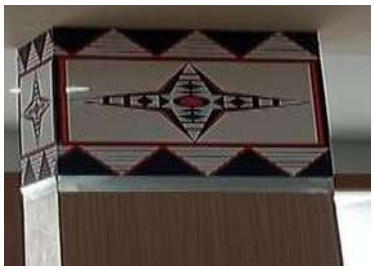

Figure 4. Ornaments on the pillars of the North Sumatra State Museum building

Figure 4 is a pole from the State Museum of North Sumatra. On the wall of the pillar, there is an ornament in the shape of a triangle. Ornaments are decorations that are intentionally made to add an aesthetic impression.

Figure 5. Headstone shape

Figure 5 is the shape of the tombstone. This headstone comes from an ancient tomb in Barus District, Central Tapanuli Regency. The presence of these graves proves the presence of Islam in Barus at least from the 11th century AD.

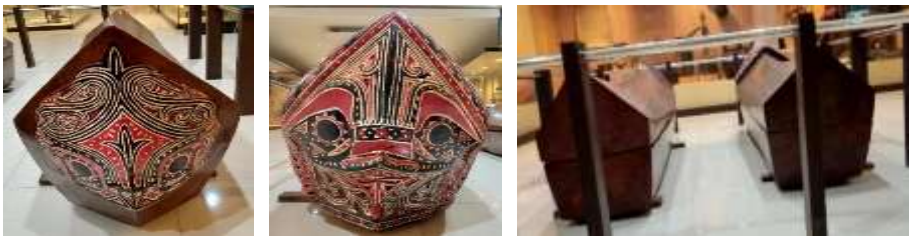

Figure 6. Fools

Figure 6 is a fake or a coffin. Abal-Abal is the traditional corpse picking of the Batak tribe. This coffin is typical with Gorga carvings and this coffin is made of one whole scraped wood.

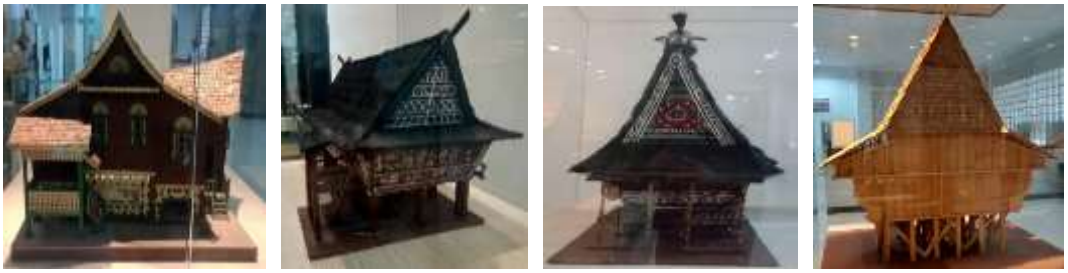

Figure 7. Miniature Traditional Houses

In Figure 7, the roof of the miniature traditional house is shaped like a gable roof. The miniature traditional houses are traditional Malay houses, Mandailing traditional houses (Bagas Godang), Simalungun traditional houses (Bolon houses), and South Nias traditional houses.

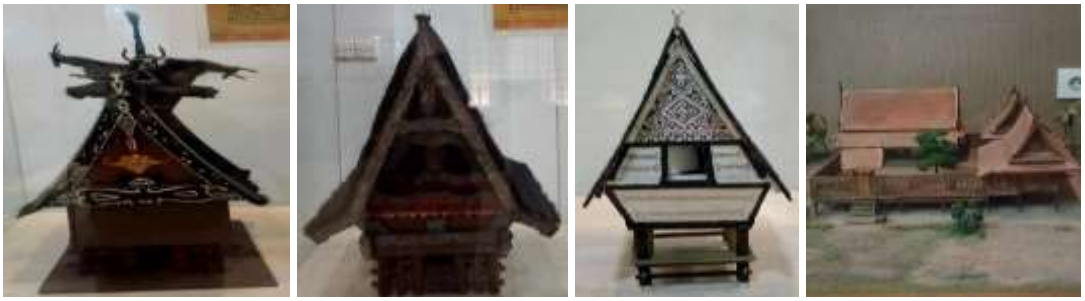

Figure 8. Miniature Traditional Houses

In Figure 8, the roof of the miniature traditional house is shaped like a gable roof. The miniature traditional houses are Pakpak traditional houses, Toba Batak traditional houses, Karo traditional houses (Sapo Page), and Thai traditional houses.

Figure 9. Community Traditional Transportation

Figure 9 is the traditional means of transportation used by the community for water, such as rivers, lakes, seas, and so on. This traditional means of transportation is known as a boat or canoe.

1. Triangle

   According to (S, 2017) Triangle is a geometric shape that has three sides in the form of straight lines and three angles. The size of the angle in the triangle is equal to 1800.

   Look up the Area value

   $$L = \frac{1}{2} \times a \times t$$

   Find the Circumference value

   $$K = a + b + c$$

   Looking for a High score

   $$t = (2 \times Luas) \div a$$

   Look up the Base value

   $$a = (2 \times Luas) \div t$$

Figure 10. Siaji Tilik

This Pustaha Lak-lak contains information about Siaji tilik, which is for safety and victory as well as getting rid of bad luck, and the things needed to achieve it, such as ulos, piso, and so on.

Figure 11. Shovel

A shovel is a tool used to find, carry and remove spilled materials, such as rocks, fine stones, cement, seeds, and so on. Shovels are generally used by people in gardening, farming, and so on.

Figure 12. Traditional fan

This traditional fan is made of woven bamboo. This fan is usually used by the community to sell satay, namely to burn satay so that the fire in the coals does not go out and is not too big.

Figure 13. Traditional Games

Chess karo is a game for children or adults to hone critical thinking skills. This activity is recreational and aims to get fun or just to fill spare time. This game was called chess in the old days. Traditional games generally have artistic characteristics or in other words have aesthetic value.

2. Square

   According to (S, 2017) a square is a geometric shape composed of four edges that have the same length and has four right angles and an angle of 900. The nature of a square is that it has four vertices, has four angles that measure 900, have two diagonals of the same length, have four fold symmetries, and have four rotational symmetries.

   Find the perimeter

   $K = 4s$

   Area Formula

   $L = s \times s = s^2$

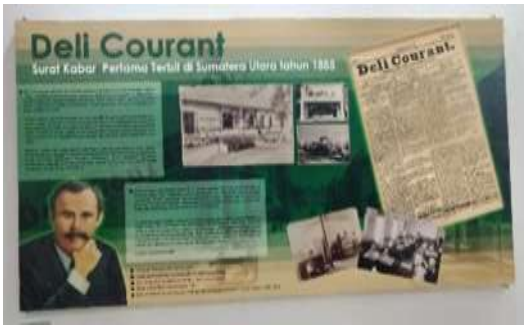

Figure 14. The First Newspaper Published in North Sumatra 1885

De Deli Courant was the first newspaper to be published in Medan in 1885. The founder of this first newspaper in Medan was J.J. Halerman. Published weekly in Dutch. At the time of its publication, De Dell Courant focused on reporting on the economic potential of plantations for colonial countries.

Figure 15. Manuscript

Manuscripts are in the form of notes that are recorded by hand and have not been published. Inside the manuscript storage area there are various records, among others,

Jurisprudence notes, Sufism texts, Tauhid texts, Arabic Grammar texts, Taju Mulok texts, An-Nisa texts or Surahs, texts on the obligatory nature of Allah, and texts containing Prayers.

Figure 16. Typical Woven Fabrics of North Sumatra

Woven fabric is any textile formed by weaving. Weaving is a technique in making cloth that is made with a simple principle, namely by combining threads lengthwise and transversely. Figure 16 is a typical North Sumatra woven fabric woven by the people of North Sumatra.

Figure 17. Mbago Ball, Nafo Ball, and Ndirabang Chopsticks

Bola Mbago is woven pandanus from Nias which is used as a betel nut. Bola Nafo is a place for betel quiver originating from Nias which is made from pandan. Ndirabang chopsticks are made of pandan. Woven with one overlapping lift technique. Used as a place for tobacco by the Pakpak tribe.

Figure 18. Amak Lampisan and Chopsticks / Horns

Amak Lampisan is a pandan mat consisting of five layers of different sizes. Used by the Angkola/Mandailing tribe as a cushion for sitting on traditional occasions. Used in traditional ceremonies as a sign of greatness. Sumpit / Tandok is a container made of pandanus used by the Toba Batak tribe to store rice or paddy.

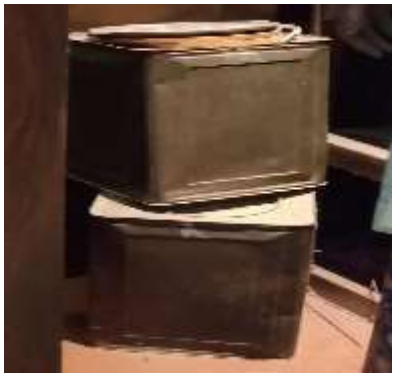

Figure 19. Storage of traditional crackers

This traditional cracker storage box is made of cans. This place is usually used by the community to store crackers so that they last longer.

3. Rectangle

   A rectangle is a geometric shape that has an area and a circumference which is composed of two pairs of ribs that are the same length and parallel to each other, and has four right angles. According to (S, 2017) The characteristics of a rectangle are that it has sides facing each other that are the same length and parallel, all sides are perpendicular, has four right angles of 900, has two diagonals with the same length, has two symmetrical, and has two rotational symmetries.

   Find the Circumference value

$$K = p + p + l + l$$
$$= 2p + 2l$$
$$= 2(p + l)$$

   Look up the Area value

$$L = p \times l$$

Figure 20. Hasapi Musical Instruments

Hasapi is a stringed musical instrument from the Toba Batak made of charcoal wood. Decorated with carvings of human motifs in a sitting position. At the end is a circle.

Figure 21. The Nine Drum musical instrument

Gendering Sembilan is a percussion instrument originating from Pakpak. This musical instrument is made of bare wood. A set of instruments is formed by nine drums and has a variety of varied measures. At the top and bottom form a circle.

Figure 22. Gondang Sembilan musical instrument

Gondang Sambilan is a typical culture of the Mandailing Batak tribe. This Gondang Sambilan is formed with nine drums with different lengths and diameters, so they can create sounds that are not the same as one another

4. Circle

   The circle is a combination of points that are equally spaced about the chosen point, which is called the center of the circle. According to (S, 2017) The characteristics of a circle are that it has a total of 3600 degrees, only has a center point in the middle, has folding symmetry, and its total rotating symmetry is uncountable.

   Circumference Formula

   $K = \pi \times d$
   $K = 2 \times \pi \times r$
   $K = \pi \times (r + r)$

   Circle Area Formula

   $L = \frac{22}{7} \times r^2$

Figure 23. Ornaments on the roof pillars of the State Museum of North Sumatra

Figure 23 is the roof wall of the North Sumatra State Museum. On the roof wall, there is a trapezoidal ornament. Ornaments are decorations that are intentionally made to add an aesthetic impression.

Figure 24. Collections of the State Museum of North Sumatra

In the place for the placement of the various collections of the North Sumatra State Museum, it appears that it is in the shape of a trapezium.

Figure 25. Sirih Teak

Tepak betel is one of the tools used in life cycle ceremonies, a symbol of respect in welcoming guests ceremonies, weddings, and the awarding of traditional titles and various other official events.

Figure 26. Bahal Temple

Bahal Temple is a Buddhist tradition located in North Sumatra, which is located in Padang Lawas Regency. The Bahal Temple was built by Rajendra Cola, the head of state of Tamil Hindu Shiva, South India and this Bahal temple is thousands of years old.

5. Trapezium

   According to (S, 2017) a trapezium is a geometric shape that has a pair of parallel sides and parallels to each other. There are various kinds of trapeziums, namely, arbitrary trapeziums, right-angled trapeziums, and isosceles trapeziums.

   Trapezoid Area Formula

   $$L = \frac{1}{2}t \times (a_1 + a_2)$$

   Circumference of a Trapezoid isosceles

   $$K = a + (2 \times b) + c$$

   The Circumference of an Arbitrary Trapezoid

   $$K = a + b + c + d$$

Figure 27. Ornaments on the pillar walls of the Museum building

Figure 27 is a pole from the State Museum of North Sumatra. On the wall of the pillar, there is an ornament in the form of a rhombus. Ornaments are decorations that are intentionally made to add an aesthetic impression.

6. Cut the rice cake

   According to (S, 2017) a rhombus is a quadrilateral consisting of four ribs of the same size and having two pairs of opposite angles.

   Find the perimeter

   $$K = 4 \times s$$

   Look up the area value

   $$L = \frac{1}{2} \times d_1 \times d_2$$

Figure 28. Makara (First Collection of North Sumatra State Building Museum)

The first collection of the State Museum of North Sumatra Province which was placed by President Soekarno in 1954. Makara is a mythical animal with the head of an elephant and the tail of a fish that lives in the Ganges River. Makara are generally represented in the form of statues and are placed in pairs in front of the left and right sides of the stairwells of the temple building. This Makara was found at the Sitopayan Monastery in North Padang Lawas Regency (approximately 400 km from Medan City) and is thought to have originated from the 9-11 century AD.

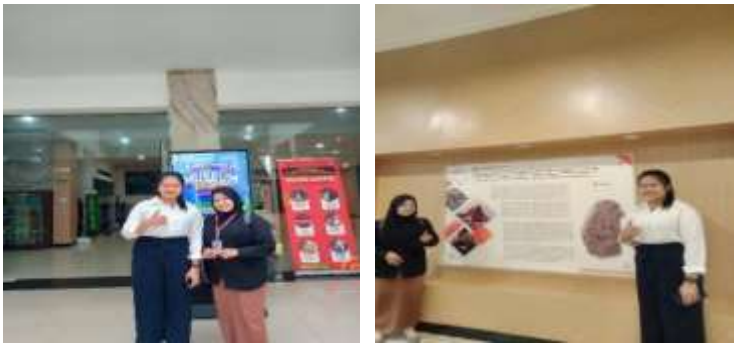

Figure 29. Group photo of one of the administrators of the State Museum of North Sumatra

The following is a photo documentation with one of the management of the North Sumatra State Museum. He is an employee or administrator who is still an apprentice at the North Sumatra State Museum.

CONCLUSION

Based on the conclusions from the study that I obtained, the Gedung Arca Museum (North Sumatra State Museum) located in Medan City can be used as a source of learning mathematics for students of various levels of education, especially in the material of Flat Geometry. After exploring the shape of the building, the building collections, and the place where these collections are placed, there is the concept of flat geometry at the Gedung

Arca Museum (North Sumatra State Museum). By utilizing the surrounding environment or culture as an object in learning mathematics, the teacher has helped students to be able to think contextually and can also accommodate students to interpret geometric concepts easily and understandably. Utilization of cultural elements in mathematics or known as ethnomathematics helps students to be able to interpret formal mathematics by starting from their daily activities. This research can be further developed to create an ethnomathematics-based learning flow in historical buildings or learning devices to optimize students' mathematical skills.

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I would like to thank my final journal article supervisor. I would like to thank the management of the Arca Building Museum (North Sumatra State Museum) who have helped me get information and collect information about the Museum and the Museum's collections. and other parties that I cannot mention one by one until the end of this journal article is finished.

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