

Volume 8 Nomor 1, Februari 2023, page 123 - 136.

Ethnomathematics Exploration At The State Museum Of North Sumatra

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ABSTRACT

Ethnomatematics can be used as a way to convey local culture and mathematics simultaneously, because ethnomatematics is a combination of culture and mathematics. The State Museum of North Sumatra is one of the historic buildings of North Sumatra which contains ethnomatematics concepts. This study aims to explore the ethnomatematics contained in the State Museum of North Sumatra. This research is a qualitative descriptive study with an ethnographic approach. The research subject was one of the officers of the State Museum of North Sumatra. Data collection techniques include observation, interviews, documentation and literature studies. The results of the study prove that there are geometric shapes and geometric shapes in the North Sumatra State Museum building and several historical heritage objects in the North Sumatra State Museum. And there is the concept of geometric transformation in the ornaments of the North Sumatra State Museum.

Keywords : Ethnomatematics, Geometry, State Museum of North Sumatra

ABSTRAK

Etnomatematika dapat dijadikan sebagai salah satu cara memberitahukan kebudayaan lokal dan matematika secara bersamaan, karena etnomatematika adalah perpaduan antara budaya dan matematika. Museum Negeri Sumatera Utara merupakan salah satu bangunan bersejarah Sumatera Utara yang mengandung konsep etnomatematika. Penelitian ini bertujuan untuk mengeksplorasi etnomatematika yang terkandung pada museum Negeri Sumatera Utara. Penelitian ini merupakan penelitian deskriptif kualitatif dengan pendekatan etnografi. Subjek penelitian adalah salah seorang petugas Museum Negeri Sumatera Utara. Teknik pengumpulan data berupa observasi, wawancara, dokumentasi dan studi literatur. Hasil penelitian membuktikan bahwa terdapat konsep bentuk geometri bangun datar dan bangun ruang pada bangunan museum Negeri Sumatera Utara dan beberapa benda-benda peninggalan sejarah di museum Negeri Sumatera Utara. Serta terdapat konsep transformasi geometri pada ornamen museum Negeri Sumatera Utara.

Kata kunci: Etnomatematika, Geometri, Museum Negeri Sumatera Utara.

How to Cite: Sagala, S. A., Hasanah, R. U. (2023). Ethnomathematics Exploration At The State Museum Of North Sumatra. *Mathline: Jurnal Matematika dan Pendidikan Matematika*, 8(1), 123 - 136.

DOI: <https://doi.org/10.31943/mathline.v8i1.364>

PRELIMINARY

Geometry is one of the elements of mathematics that is very attached to real life, because there are several visual objects around students which are geometric objects (Yanti & Haji, 2019). Some examples of geometric objects that exist in student's lives are notebooks in the form of rectangles, clocks in the form of circles, tiles in the form of square flat wakes. Therefore, geometry is an important aspect that students must learn (Novita et al., 2018). According to (Nur'aini et al., 2017) geometry is the study of points, lines, planes, space, dimensions and properties of shapes, both spatial and flat. (Huda, 2018) stated that geometry is one aspect of the discussion in the education curriculum starting from the elementary level to the higher education level. However, geometry is one of the most difficult mathematics lessons for students to learn. This is in line with the statement (Sholihah & Afriansyah, 2017) that student learning outcomes in the field about geometry are still relatively low because many students find it difficult to understand geometric concepts.

In order for students to easily explore mathematical concepts, namely the concept of geometry, certain methods are needed that are in accordance with students' understanding. According to (Lisnani et al., 2020) one alternative that can be used as a bridge to understand abstract geometric concepts is ethnomathematics. Ethnomatematics is an act that links numbers, geometric patterns, to the application of mathematics that involves local culture (Pratiwi & Pujiastuti, 2020). (Sulistyani et al., 2019) also stated that ethnomathematics is a field of study that can be used to show the involvement between culture and mathematics. Using ethnomathematics as a learning resource can foster student creativity in solving mathematical problems including geometric concepts (Nurjanah, 2019). The contribution made by ethnomathematics in improving the quality of learning is very large, because it is related to the local culture of students, making it easier for students to understand geometric concepts (Sulistyani et al., 2019). Based on these, it can be concluded that mathematics cannot be separated from local culture.

The use of ethnomathematics in mathematics research has been carried out by several researchers, namely by linking mathematics with local culture in the form of traditions, traditional games, regional languages, traditional clothes and traditional houses of a particular area. One of the provinces in Indonesia that has a lot of cultural diversity is North Sumatra. As a multi-ethnic area, North Sumatra has a variety of cultures, both languages, religions, tribes, traditional houses and traditions (Laudra et al., 2021). There are several ethnomathematics studies in North Sumatra, some of which are: (1)

Ethnomathematics exploration of the Maimun Palace in North Sumatra, there are evidence of mathematical operations in planning the construction of the Maimun Palace and making the pattern for the walls of the Maimun Palace (Rizqi et al., 2022), (2) Ethno-mathematical exploration of the Gordang Sambilan musical instrument, the results of the study show that there are concepts of arithmetic sequences and geometric concepts in these musical instruments (Lubis et al., 2018), (3) An ethnomathematics study of Bagas Godang shows that there is a mathematical concept in the form of geometric transformations (Dewita et al., 2019).

Based on the ethnomathematics research on the local culture of North Sumatra, it can be concluded that North Sumatra has many different cultures that can be used as materials for learning mathematics. However, there has been no research discussing ethnomathematics at the State Museum of North Sumatra. Research conducted (Setiana et al., 2021) regarding ethnomathematics exploration at the Yogyakarta Kraton Railway Museum shows that there are concepts of flat shape area, spatial volume, and symmetry in the Yogyakarta Kraton Railway Museum. And research done (Wahyuni & Alifia, 2022) regarding ethnomathematics at the Probolinggo museum also shows that there is flat geometry and row patterns at the Probolinggo museum. The two studies on regional museums can be used as a basis that the State Museum of North Sumatra is not only a cultural monument of North Sumatra, but can be used as a bridge to understand the concept of learning mathematics. The North Sumatra State Museum is also part of the local culture of the North Sumatra region (Lestari Neneng Y; Rambe, Yunita Safitri, 2018). The museum is a tourist object in which there are historical objects to deepen or add insight and knowledge (Brata & Brata, 2018). So it is necessary to carry out further research to explore the State Museum of North Sumatra. Figure 1 is an image of the State Museum of North Sumatra.



Figure 1. State museum of North Sumatera

The purpose of this research was to explore the State Museum of North Sumatra extensively with the application of ethnomathematics. In this case the researcher is trying

to identify the real picture of the State Museum of North Sumatra based on the concept of mathematics as a learning resource for students. So that the absorption of learning is not only through class but also from outside, especially at the State Museum of North Sumatra. This research is also expected to help students in North Sumatra to get closer to their culture.

METHODS

This research is a descriptive qualitative research with an ethnographic approach, where the field or the surrounding environment is the main data source. Ethnography is an activity to analyze or describe the social life, traditions and culture of the people in the field (Windiani, 2016). In this study the data collection techniques applied were observation, interviews, documentation and literature study. The steps applied by the researcher are:

1. Literature study of articles that contain or discuss ethnomathematics studies, geometry and the State Museum of North Sumatra.
2. Prepare research instruments in the form of interviews..
3. Visited the State Museum of North Sumatra and interviewed the State Museum of North Sumatra staff, who was an informant In this study.
4. Documenting matters relating to the State Museum of North Sumatra.
5. Analyzing the results of the documentation obtained, and linking them with the concept of geometry.

Table 1. Interview Instruments

No.	Elements Of The Museum	Questions
1.	Museum	What is the history of the North Sumatra State Museum?
2.	Museum	What is the building area of the North Sumatra State Museum?
3.	Museum	When was the North Sumatra State Museum built?
4.	Museum	How many visitors to the Sumatra State Museum on average per day?
5.	Museum	In the process of construction or renovation, whether there are parts that are changed from the original?
6.	Museum	What is the meaning of architectural creation in museums?
7.	Museum	What is featured in the North Sumatra State museum?
8.	Museum	What is the number of floors of the North Sumatra State museum?
9.	Museum	How is the distribution of the layout of each collection of the North

No.	Elements Of The Museum	Questions
		Sumatra State Museum?
10.	Museum	What about the completeness of the collection of the North Sumatra State Museum?
11.	Museum	How to maintain and secure the collection of North Sumatra State museum?
12.	Roof Ornaments	What is the meaning of the ornaments on the Roof of the North Sumatra State museum?
13.	Roof Ornaments	Berapakah jumlah ornamen yang terdapat pada museum Negeri Sumatera Utara?
14.	Roof Ornaments	How many ornaments are found in the North Sumatra State museum?
15.	Roof	Are there any rules in making architecture on the Roof of the North Sumatra State Museum?
16.	Roof	What is the meaning contained in the shape of the roof of the North Sumatra State Museum?
17.	View the Roof Peak	What is the meaning contained in the shape of the view of the roof peak of the State Museum of Sumatra?
18.	Miniature Traditional House	How many Miniature Traditional Houses are found at the North Sumatra State Museum?
19.	Miniature Traditional House	What is the meaning contained in each Miniature Traditional House?
20.	Coffin	What is the meaning contained in the creation of the Coffin architecture?
21.	Coffin	What is the history of Coffin?
22.	Coffin	How much Coffin is found in the North Sumatra State Museum?
23.	Osa-osa	What is the meaning contained in the form of osa-osa?
24.	Osa-osa	What is the history of the osa-osa?

Table 1 is a number of questions that will be asked to the State Museum of Sumatra during the interview.

RESULTS AND DISCUSSION

The results of the research can be used as evidence that the people of North Sumatra still maintain the cultural and historical heritage in the area of North Sumatra, by storing historical objects in the State Museum of North Sumatra. Based on interviews conducted with the management of the North Sumatra State Museum, there is a treasury of objects from prehistoric times to the independence revolution. Starting from traditional musical instruments, traditional gardening tools, traditional transportation equipment, traditional cutlery, traditional fishing equipment, old currency, and others. Here are some examples of historical objects in the State Museum of North Sumatra, namely: pictures of 2 miniature houses in North Sumatra, pictures of 3 coffins and pictures of Osa-Osa.



Figure 2. Miniature of the traditional house of North Sumatera



Figure 3. Coffin.



Figure 4. Osa-osa





Several miniature traditional houses in the Museum of North Sumatra can be seen in Figure 2. Starting from the Sopo Page Karo traditional house, the Bolon Batak Toba traditional house, the Karo traditional house, the Pakpak traditional house, the Nias traditional house, the Bagas Godang traditional house, and the Malay house. In addition to miniature traditional houses, there is also a coffin which can be seen in picture 3. The coffin from southern Nias is decorated with the head of Lasara, a mythical animal in ancient Nias religion. At the top of the coffin lid was found a lying male figure. The coffins were made for nobles who were seen as having sacrificed for the village and were placed at the front of the village. Osa-osa is also found in the State Museum of North Sumatra, as can be seen in Figure 4. Osa-osa is an adu (statue) that functions as a chair or seat in ceremonies. This statue depicts Lasara, a mythical animal in Ancient Nias religion. Materials for making osa-osa are either wood or stone. The culture of making osa-osa is

popular in Southern Nias. The one-headed osa-osa is generally used to seat the groom or the king, while the three-headed osa-osa is used as the bride's seat.

In addition to housing historical heritage objects, the State Museum of North Sumatra can also be used as a learning tool for students and the people of North Sumatra to further pursue local cultural links with mathematics. Below is ethnomathematics found in the museum of North Sumatra.

1. Geometric shapes

Table 2. Flat geometric shapes at the State Museum of North Sumatra

Elements Of The Museum	Geometric Shapes	Description
	Triangle	The roof surface of the North Sumatra State Museum on the front is in the form of a triangular flat shape
	Triangle	The roof surface of the Sumatra State Museum on the back is a triangular flat shape
	Trapezoid	At the back of the museum there is a monument which is usually used as a place for visitors to take pictures. The surface of the monument at the top is a flat trapezoidal shape
	Trapezoid and Triangle	In the chopsticks there are two combinations of flat shapes, namely at the base/bottom of the chopsticks in the shape of a trapezoid and at the top of the chopsticks in the shape of a rectangle. Peneturen chopsticks are rice or paddy containers made from pandanus and are usually used by the Karo tribe.


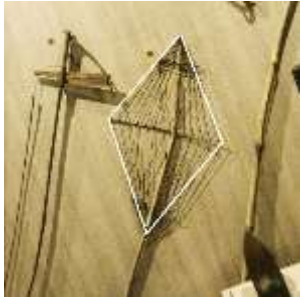









Elements Of The Museum	Geometric Shapes	Description
	Rectangle	The pattern on the nafo ball is in the shape of a square flat shape. Bola nafo is a place for betel quiver from Nias made of pandanus.
	Rhombus	In traditional fishing equipment, the tip or top is a rhombus-shaped flat shape. In the past, people caught fish using only traditional fishing equipment.
	Octagonal	In the plantation currency, there is an octagonal flat shape. Plantation currency is issued by plantation owners to pay laborers and can only be used in plantation areas.
	Circle	Apart from being octagonal in shape, there are also plantation currencies in the form of a circular flat shape.
	Triangles and rectangles	On the replica of the tombstone at the foot of the high plank tomb there are two combinations of flat shapes, namely a triangular shape at the top and a rectangular bottom at the bottom. This tombstone replica comes from the Barus sub-district.

Table 3. The geometry of the geometric shapes of the North Sumatra State Museum

Elements Of The Museum	Geometric Shapes	Description
	Cone	A bamboo hat in the shape of a conical shape. Usually these bamboo hats are used to work in the fields or in the fields by the Toba Batak tribe.
	Cylinder	The container used to store spices is in the form of a cylinder shape with different sizes
	Cone	Traditional livestock tools in the form of a conical shape. The tool is made of bamboo, and is used as a cover for chickens or chicken cages
	Heptagonal	Several currencies during the revolution in North Sumatra were arranged to form a heptagonal prism.
	Cuboid	A place to store jewelry or valuable objects in the shape of a block shape. Usually these objects are made of carved wood.
	Octagonal prism	The ancient Nisa is in the form of an octagonal prism. This gravestone comes from the Barus sub-district, Central Tapanuli district. The presence of the tombstone proves that the presence of Islam in Barus from the 11th century AD


Elements Of The Museum	Geometric Shapes	Description
	Cube	The pedestal used to place the statues in the museum is in the shape of a cube, including the place used for the pangulubalang statue. The pangulubalang statue is a statue used by the Ancient Batak to guard the fields.

Table 2 illustrates the flat geometric shapes found in the North Sumatra State museum, both based on the shape of the Sumatra State museum building and the objects in the Sumatra State museum. While table 3 is the geometric shapes of the geometric shapes found in the State Museum of North Sumatra. Both from the North Sumatra State museum building itself and historical objects in the North Sumatra State museum.

2. Geometric Transformation

The ethnomathematics elements found in the State Museum of North Sumatra are not only geometric shapes, but there are also other ethnomathematics elements, namely geometric transformations. The geometric transformation is a shift in the initial position in the form of (x, y) to the position (x', y') (Hasibuan & Hasanah, 2022). The following is an ethnomathematics element of geometric transformation at the State Museum of North Sumatra.

Translation

Translation is part of a geometric transformation which functions to move all building points in the same direction and distance (Edi, 2021). The concept of translation at the State Museum of North Sumatra can be found on the roof ornaments of the museum Like picture 5 and can be found in regional motif ornaments as shown in picture 6.



Figure 5. The roof ornament



Figure 6. Regional Motif Ornament

Figure 5 is a suleppa ornament that combines geometric type motifs with plants, this motif originates from the Simalungun area and has the meaning of a symbol of unity and welfare of the Simalungun people (Saragi, 2018). In Figure 5, we find n scale translations of

suleppat ornaments amounting to n (roof width). Meanwhile, Figure 6 is an ornament with the motif of a lizard animal originating from the Karo area and has the meaning of fertility and protection (Saragi, 2018). In Figure 6 it is found that the n -scale translation of the starched ornament is found 7 times.

Reflection

Reflection is the activity of moving a shape or object with the same value between the starting point and the displacement point so as to produce an image of an object like a mirror (Hada et al., 2021). The concept of reflection can be found in padung as shown in Figure 7 and can be found in the roof ornaments of the museum as shown in Figure 8.



Figure 7. Padung

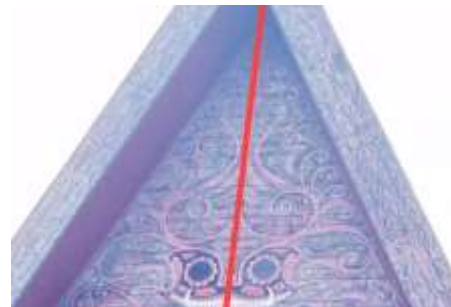


Figure 8. Roof Ornament

Figure 7 is a padung made of silver, usually used to decorate the hoods of noble Karo women. Figure 8 is a Gorga ulu paung ornament from the Toba Batak region in the form of a giant head which means might to protect the occupants of the house from demons (Purba, 2016). In Figures 7 and 8 there is a left or right reflection.

Dilation

Dilation is moving objects by changing their size, either enlarging or reducing them without changing their original shape (Arwanto, 2017). The concept of dilatation can be found in miniature Karo traditional houses as shown in Figure 9 and can be found in traditional cutlery as shown in Figure 10.



Figure 9. Karo Traditional House Miniature



Figure 10. Tradisional Tool

In Figure 9, dilation occurs, where the initial size of the miniature roof of the Karo house is large, then every one level up the size of the miniature roof of the Karo house will get smaller but still does not change its initial shape. The dilation that occurs in Figure 10 is similar to Figure 9, that is, the higher it is, the smaller the pattern will be.

Rotation

Rotation is the activity of rotating an object with a fixed axis (Hasibuan & Hasanah, 2022). The concept of rotation occurs in the basic flagpole ornament in front of the State Museum of North Sumatra as shown in figure 11



Figure 11. The basic ornament of the flagpole

In figure 11 there are 8 patterns in one full rotation, so that the rotation that occurs in the basic ornament of the flagpole of the State Museum of North Sumatra is 45° .

CONCLUSION

Based on the discussion above, it can be concluded that there is a relationship between the concept of geometric mathematics and culture at the State Museum of North Sumatra. Both seen from the shape of the Sumatra State Museum building as well as objects of historical heritage in the form of flat shapes and geometric shapes. As well as ornaments on the museum building and several objects in the museum that contain the concept of geometric transformation. The application of this museum context can make it easier for students to pursue the concept of geometric shapes, geometric shapes and geometric transformation concepts, because they are attached to student's daily lives.

By integrating ethnomathematics into learning it can build student's mathematical problem solving skills, as well as being able to introduce elements of the richness of the regional culture so that students appreciate more the use of mathematics in everyday life. Teachers are expected to be able to innovate with ethnomathematics-based mathematics learning. Given that ethnomathematics is an alternative between culture and mathematics, schools should provide teachers with adequate supplies and guidance.

Mathematical concepts that have been discovered can still be explored and modified in the form of teaching materials with attractive designs so that they can be taught in the classroom. Researchers suggest further research on the development of mathematics learning tools based on the State Museum of North Sumatra on geometry material so that it can be applied in learning mathematics. In addition, researchers suggest other explorations related to North Sumatran culture.

ACKNOWLEDGMENTS

Thanks to the State Museum of North Sumatra for assisting in this research process to provide information about the State Museum of North Sumatra.

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