Sosioedukasi
JURNAL ILMIAH ILMU PENDIDIKAN DAN SOSIAL
ISSN: 2086-6135 E-ISSN: 2541-612x
Volume 14 No. 1. May 2025 https://ejournal.unibabwi.ac.id/index.php/sosioedukasi/index

ETHNOMATHEMATICAL EXPLORATION IN THE ARCHITECTURE OF THE ICONIC BUILDING OF SOPO PARTUNGKOAN CITY OF TARUTUNG

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ARTICLE HISTORY
Received : 15-05-2025
Revised : 18-05-2025
Accepted : 30-05-2025

KEYWORDS
Mathematics,
Culture

ABSTRACT
The concept of mathematics will always be found in daily life. The concept of mathematics is then associated with a culture, so it is called Ethnomathematics. Ethnomathematics is one of the scientific research methods that connects an ethnicity with mathematical concepts, this research contains an exploration of what mathematical elements are found in the architecture of the iconic building of Sopo Partungkoan Tarututung City. The purpose of this research is to find out the mathematical elements that exist in the architecture of Sopo Partungkoan. This research is a type of descriptive qualitative research that obtains data sources through observations, documentation and interviews related to the Sopo Partungkoan building. This research was carried out at the Sopo Partungkoan Building, Tarutung City in April 2025. The results of this study show that the architecture of the sopo partungkoan building contains a lot of mathematical elements including, Triangle, square, rectangle, parallelogram, circle, coherence and congruence, reflection and fibbonaci concept

INTRODUCTION

Indonesia is the largest country in the world, this can be seen from the diversity of ethnicities, cultures, languages, traditions, customs, religions, races, beliefs and culinary throughout Indonesia. one of the largest provinces is North Sumatra. The Batak tribe originated from North Sumatra. The Batak tribe consists of Angkola, Karo, Mandailing, Pakpak/Dairi, Simalungun and Toba. One of the cultural richness of the Batak tribe is in terms of its traditional houses, namely ornaments, this diversity will give birth to art forms that symbolize the origin of the tribe. (Regita, 2018)

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Learning mathematics by relating elements of the culture around us is the definition of ethnomathematics. Ethnomathematics itself is defined as a form of mathematics learning that is associated with customs, habits, or anything related in a culture. Therefore, this study wants to explore what mathematical elements exist in the architecture of the iconic building of Sopo Partungkoan, the city of Tarautung (Bayu, 2021) .

The exploration according to Supardan is the study of constructivism, which has become a popular and evolving approach in the practice of learning today. (Sari et al., 2022) This researcher also explained exploration as a medium as a means for students to explore their talents and interests according to their skills. (Fauzi Then , 2022)Ethnomathematics is forged through experience, reflection, delusions, and hopes for the use of modern science, especially mathematics, for a better quality of life for the entire human species.

(Wade , 2022) A traditional house is a building that has special characteristics and uses for the residence of a certain tribe. Along with the development of times and technology, the use of traditional houses as a place to live has begun to be abandoned. But this does not mean that the community should forget the potential of traditional houses as part of culture. One of the tribes in North Sumatra that has a unique traditional house is the Toba Batak tribe. They call their traditional house "Bolon House". The shape of the Bolon House is a building with a special physical appearance that is equipped with various ornaments and colors that symbolize the meaning and personality of the community (Saragih , 2020) (Regita, 2018) .

In North Tapanuli district, there is a building that is an iconic building that is often visited by tourists. This building has a similar shape and beauty to the traditional house of the Toba Batak ethnic group, namely "Rumah Bolon". And the building is known as "Sopo Partungkoan". The shape of the Bolon House is: a building with a special physical appearance equipped with various ornaments and colors that symbolize a meaning and personality of the community. Batak traditional houses have constructions that give rise to the image of nature and are also considered to have a soul (Regita, 2018) (Sihombing & Tambunan, 2021) .

(Sigh) Nursita , 2016) In the article, it is written that Sopo Partungkoan is located in the center of Tarutung City. Sopo Partungkoan is a building with the background of a Batak traditional house that stands sturdy and is the largest when compared to other Batak traditional houses. Sopo Partungkoan is a two-story house. The house has a curved roof and is shaped like a horse saddle. Sopo Partungkoan is usually used to organize various arts and cultural activities, festivals, and others.

Analyzing the shape of the iconic building of sopo partungkoan will find many mathematical forms. The researcher chose a building with a Batak Toba ethnic background, a bolon house, namely "sopo partungkoan" located in Tarutung City, North Tapanuli Regency. The above is also the reason for the author to choose the title of the research "Ethnomathematical Exploration in the Architecture of the Iconic Building of Sopo Partungkoan Tarutung City"

The following author presents a table of previous similar research, along with its differences and similarities.

Table 1, Previous Research, and Their Similarities and Differences

Yes	Relevant research	equation	difference
1.	Dewi Yuniarti Bayu's thesis, with the title *"Ethnomathematical Exploration in the Langkanae Palopo Traditional House"*	Ethnomathematical exploration of a traditional house building and Types of qualitative research	Refers to the concept of flat building and building space
2.	Susi Sihombing & Hardi Tambunan Journal, with the title *"Ethnomathematics: Exploration of Geometric Concepts in the Ornament of the Bolon Batak Toba House"*	Ethnomathematical exploration of Batak cultural buildings, types of qualitative research with an ethnographic approach	Exploring the buildings in the traditional house

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3.	Journal (Elvi Mailani, et al) with the title *"Ethnomathematical Exploration of the Geometry of Triangle Flat Buildings in Traditional Clothing of the Typical Sortopi of the Toba Batak Tribe"*	Exploration of the ethnothematic culture of the Toba Batak and the types of qualitative research	Refers to ornaments in traditional Batak Toba clothing
4.	Azhari Dewita's journal entitled *"Ethnomathematical Studies against Bagas Godang as an Element of Mandailing Culture in North Sumatra"*	Ethnomathematics on cultural buildings dating from North Sumatra	Exploring the carvings found in Bagas Godang Budaya Mandailing
5.	Resi Marlia Sari in her thesis entitled "Ethnomathematical Exploration in Bengkulu Traditional Houses to Understand the Concept of Building Space"	Ethnomathematics on cultural buildings	Studying the carvings of traditional houses in Bengkulu

After reading the table of differences and equations above, it is known that the five studies are relevant to this research and the relevance is Ethnomathematical Exploration in Cultural Buildings.

RESEARCH METHODS

This research is a descriptive qualitative research. In the book (Salim 2024), it is said that Staruss and Corbin explain that qualitative research is research that does not use statistical or quantification procedures. In this study, the ethnographic approach is the approach chosen by the author. The purpose of the ethnographic approach is to conduct an in-depth analysis and describe in detail matters about culture in accordance with field research. The author tries to get information through literature, observational observation and physical documentation accompanied by one of the staff of the North Tapanuli Regency Government. The purpose of this research is to describe in detail the results of ethnomathematical exploration in the Iconic Sopo Partungkoan building in Tarutung City related to mathematical elements.

RESULTS OF THE DISCUSSION

Result

The mathematical elements found in the Architecture of the Sopo Partungkoan Iconic Building are:

1. Triangle

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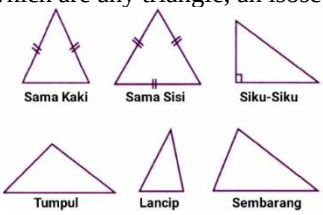
A triangle is a flat structure consisting of three line segments where each end of two line segments meets. Triangles are divided into two based on the size of their angles, namely taper triangles, right triangles and blunt triangles. And based on the length of its sides, which are any triangle, an isosceles triangle and an equilateral triangle.



1. Trapezoid

The trapezoid is included in the quadrangle, namely a Quadrangle which has a pair of parallel sides. The trapezoid is divided into two, namely the isosceles trapezium, which is a trapezoid whose two sides are parallel and the two legs or upright sides are the same length, and the corners are not right. And the right trapezoid is a trapezoid where one of the corners is at right (Suharjana Agus, 2009) angles.

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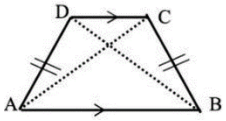

2. Square

A rectangle that has four sides is the same length and the four corners are right is called a square.

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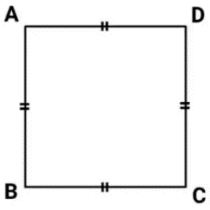

3. Rectangle

A rectangle that has a pair of parallel sides and one of the corners is right at the right is called a rectangle.

4. Split Ketupat

Ketupat split is a rectangle whose four sides are the same length. Parallelogram whose two adjacent sides are of the same length is also called rhombus.

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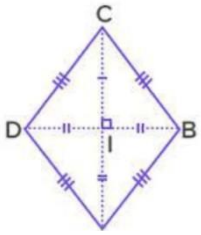
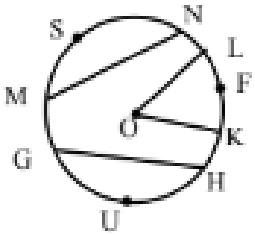


5. Circle

A circle is a flat shape whose sides are always the same distance from the central point. In other words, a circle is the place where points are located on a plane, and are equally spaced from a certain point (Suharjana August , 2009).



6. Parallel Lines

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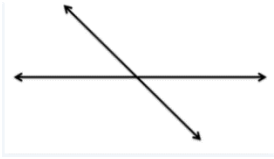
If there are two lines on a flat plane, it is said to be parallel lines when the ends of the two lines are drawn or extended, they will never meet each other.

7. Intersecting Lines

If two lines are located on one flat plane and have a cutoff point or common point and the point forms 4 lines meeting each other at that point then it is called a cross-sectional line (Kusmayanti Vera , 2020).



8. Reflection

When a person does a reflection, a mirror is needed as an axis of symmetry or line of reflection. Take a look at the picture below, there is an ABC *triangle ABC mirrored* against the k-line into the triangle A′B′C′*A′B′C′*

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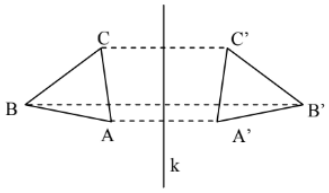

The properties contained in the reflection shadow are the image of the shadow of the sam upright with the original object. The distance of the shadow image from the mirror is as far as the distance from the object from which the mirror originated. The size of the shadow is the same as the ukuras of the original object, only I draw the opposite. And finally, the image of the shadow and the original object is always perpendicular to the mirror.

When doing reflection, there is a point that will not change (fixed), namely on the line of the mirror. This unchanging line is called or commonly known as the axis of symmetry. When an object has a symmetrical axis, it is directly said to be a symmetrical object. A symmetrical object is an object or building that has a symmetrical line that can divide a building into two parts, then the two parts (congruent) are the same and constructed.

Discussion

The results of observations, documentation, interviews, obtained during the observation on April 23, 2025 at Sopo Partungkoan are:

Sopo Partungkoan, a building with historical value in a beautiful small town called Tarutung. Sopo Partungkoan in the past was used as a place to barter and trade which today we know a place like this is by the name of the market. However, over time Sopo Partungkoan changed its role to become a place rich in the history and culture of North Tapanuli, and now it also functions as an art building and event venue. (Sibatak road , 2020)

In addition to having a sacred historical value of Toba Batak culture, it turns out that this research makes it clear that the Partungkoan sopo building has many elements of Mathematics in terms of the architecture of the building. Observe the picture of the sopo partungkoan building above if we are right in front of the building. At first glance, we can find a lot of mathematical elements that exist. Starting from the shape of the building like the

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arrangement of three flat buildings. On the ground floor it is rectangular, then on the second floor it is rectangular and as the top building is shaped like a triangular flat building.

The bottom building that underlies the Partungkoan Sopo building is used as a gallery for MSMEs in Tarutung City, initially the bottom of this building was only used as a warehouse. This warehouse is used as a place to store chairs, tables and other things that are commonly used for large events on the second floor. This was explained directly by the Regent of North Tapanuli in 2021, Mr. Drs. Nikson Nababan, M.Si during the interview at the launch of the MSME Gallery.

Seen from the front, the base of this building is divided into three parts. The left side consists of five pillars, then is bounded by an entrance. The middle part is a staircase that leads to the entrance to the second floor. The right part is exactly the same as the left part. On the right and left of the ground floor, each pillar is joined by wood that is shaped like a rectangle and matches each other's size and layout. The entrance to the lower floor is also designed in a rectangular shape. At the time of this research, the interior of the ground floor was being renovated. So that the author did not get a decent image to be published in this study.

The second floor in the picture also depicts the shape of a rectangular flat building. See and observe from the picture above, that the bottom of the second floor has a full gorga (painting/sculpture). The farthest part of the right and left ends with a statue or 3D carving. A two-dimensional painting depicting several buffaloes and people ploughing rice fields. Followed by two sculptures of lizards facing the gorga (carving) of the breast. And it is met with a typical Toba Batak carving which depicts two parallel lines and two intersecting lines.

This central building is composed of several rectangular woods. It is equipped with a window on the front of the building, and is also rectangular. The middle of the front of the second floor building also has 3D carvings. Just like the most basic building architecture. The front of the second floor on the right and left is the same, there is no difference between the two, so if a symmetrical line is drawn, each abgian can occupy the other part. This building was built with great calculation.

Pay attention to the beauty and elegance in the picture below, the researcher will present the core part of the Sopo Partungkoan Building. Namely the inside of the second floor, which functions as a place for art events, events and so on.

The picture above was taken by the writer right in front of the main stage of the building. Parallel to the stage, the audience will be faced with the main entrance of the building which is also rectangular. Notice that on the right and left both have rectangular windows of similar size and size. Then the left and right parts are also limited by two pillars each which become pillars that have the same size and length on both sides. Two doors that are the same size on the left and right, are also rectangular in shape and in the middle are entrances similar to the shape of a rectangular room.

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Like the front of the building, this part is also bordered by a similar batak gorga (carving). Gorga (carving) that contains mathematical elements in it. Each image that is parallel and intersects will form a flat shape. The flat building that was created was a rhombus flat building. Not to forget there are also several 3D carvings that are characteristic of the Toba Batak culture.

The top part is shaped like a parallelogram, this part is also the most important part because it functions as a seat for invited guests when the Sopo Partungkoan building is being used for art events and events. Right in front of the main entrance we will see a simple stage full of thousands of young stories of North Tapanuli youth.

The picture above is an appearance of the rectangular-shaped pangung in the sopo partungkoan building. On the right and left sides of the stage were found walls with a woven style model. A webbing that produces square drawings. Both the right and left sides of the stage look the same. Right on the stage, it is exactly the same as producing a parallelogram flat building like the audience seats facing each other. The researcher also realized that the roof in the sopo partungkoan building was arranged and formed from wood in the shape of a square and rectangular. In this part, it is also added with circular and neatly arranged decorative lamps. The arrangement of the decorative light bulbs corresponds to the arrangement of the number pattern.

On the left and right sides of the building are surrounded by pillars of similar number and size. There are about ten pillars and five windows that are parallel and paired. Of course, it is also equipped with a typical carving of Batak Toba which is full of meaning. The top outer part which the researcher will call the third floor, there will be a lot of mathematical elements that will be found in the architecture of this part of the building. Starting with a very clear triangular shape, the shape of the triangular flat building on the front roof of this building becomes "identification, characteristics, special features" or other designations. The triangular buildings in this section are also not just one.

Look and notice that there are three layers of a rectangle. The innermost layer is smaller in size when compared to the size of the triangle that is right in front of it. In the next triangle the size is larger than the size of the previous triangle. However, the size of this triangle is smaller when compared to the triangle after it. What is meant is the outermost triangle of the building. A triangle that is larger in size than the previous two triangles. Three triangles are said to be similar because they have two pairs of points, in two corresponding buildings and in both buildings the distance is proportional to the distance of the other two pairs of points. And it is not a congruent building.

On the right and left of each triangle line (roof) on the Sopo Partungkoan building there are carvings in the shape of a circle. Each circle carving has 22 on each side. If added up on both sides, there are 44 circular carvings. Look at the carvings on the divider between the top floor and the lower floor. The author found a very beautiful mathematical element, namely spiral-shaped carvings that follow the Fibonaci Series pattern. There are about five spiral-shaped carvings at each corner of the second floor and the third floor.

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The picture above is the left side of the Sopo Partungkoan building. The very bottom of this building makes 25 pillars or pillars as a milestone for the establishment of this beautiful building. Then it is limited to the typical carvings of Toba Batak which also contain mathematical elements as explained by the researcher above. Likewise, the outside of the second floor shows five pairs of square-shaped windows. And the roof is in the form of a parallelogram if divided in half according to what the researcher has shown above.

Until now, the North Tapanuli Regency Government is still continuing to renovate and also build the Sopo Partungkoan Building and its surroundings. At that time, the resource person in this study explained that on April 26, 2025, the Sopo Partungkoan building will be used as a place to celebrate the Easter holiday (Christians). So that the management parties must carry out mutual cooperation to prepare for the celebration. Therefore, that is also the reason why some documentation is equipped with students and female students who are working together. There were around 20 students who participated in the mutual cooperation event.

CONCLUSION

The conclusion of the results of this research is that ethnomathematics is a scientific method that relates ethnicity and mathematics. The Ethnomathematics studied by the author is about the mathematical elements contained in the architecture of the iconic building of the Tarutung City of Partungkoan. Where there are many mathematical elements of building a flat triangle and building a square flat. Some mathematical elements exist in the architecture of the iconic building of the Tarutung City of Sopo Partungkoan: the front roof of the building is triangular and the harmony between the three triangles, the side roof forms a trapezoid, the windows on the building form a square, the arrangement of the inner ceiling is rectangular, the carving of the outer front has circular and spiral elements that have a Fibonaci series pole, The beautiful carvings on the inside and outside of the building have mathematical elements of intersecting lines and parallel lines. For 3D sculpture carving, it has symmetrical mathematical elements.

Suggestion

Seeing what are the problems contained in this study, namely research on Ethnomathematical Exploration in the Architecture of Sopo Partungkoan Iconic Buildings, the author has the following suggestions:

1. This research was carried out to find mathematical elements in general without having to involve and pay attention to the material at the school level. For this reason, the researcher suggested that the research be able to relate cultural elements to school mathematics materials and be discussed in more detail.
2. Researchers have a lot of shortcomings, especially when taking pictures of research objects. This happened due to the limitations of researchers. For this reason, the researcher suggested that further research use professional cameras
3. The researcher hopes that this can be used as a reference for further research and more details about what mathematical elements exist in the Sopo Partungkoan building, Tarutung City.

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BIBLIOGRAPHY

Bayu. (2021). *Eksplorasi Etnomatematika Pada Rumah Adat*.

Fauzi Lalu. (2022). *Buku Ajar Etnomatematika*.

kusmayanti vera, Y. (2020). *Garis Dan Sudut*.

Regita, R. (2018). Kajian Bentuk, Fungsi Dan Makna Ragam Hias Rumah Bolon Simalungun Berdasarkan Tatanan Sosial Budaya Masyarakat Simalungun. *ARTic*, *2*, 73–82. https://doi.org/10.34010/artic.2018.2.2525.73-82

Saragih. (2020). *RuBmah Adat Bolon Sebagai Warisan Budaya DiDesa Pematang Purba Kabupaten Simalungun*.

sari nursita. (2016). *Menjajal Pariwisata Kawasan danau Toba* .

Sari, S. M., Mahlia, Y., Sari, W. A. K. W., & Jalaluddin, J. (2022). Manfaat Pembelajaran Eksplorasi, Elaborasi, Dan Konfirmasi Pada Tanggung Jawab Guru. *Educate : Jurnal Teknologi Pendidikan*, *7*(1), 89. https://doi.org/10.32832/educate.v7i1.6268

sibatak jalan. (2020). Tarutung Tempo Dulu Sejarah Lengkap dengan Masyarakat adat Batak di Silindung Berwarna . In *sibatak jalan jalan.com*.

Sihombing, S., & Tambunan, H. (2021). *Etnomatematika: Eksplorasi Konsep Geometri Pada Ornamen Rumah Bolon Batak Toba*.

suharjana agus, M. W. H. (2009). *Geometri Datar dan Ruang*.

wahyuni. (2022). *Etnomatematematika*.