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ETHNOMATHEMATICS: CONCEPS OF MATHEMATICS IN THE CONTEXT OF "*SIWALUH JABU*" KARO TRADITIONAL HOUSE

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ABSTRACT

One of the Karo traditional cultures that incorporates elements of ethnomathematics in its shape is the "*Siwaluh Jabu*" roof design. In order to apply the mathematical ideas discovered as a method for teaching mathematics in schools, the study's objective was to investigate the mathematical ideas present in the "*Siwaluh Jabu*" roof design. Through observation, interviews, documentation, and an ethnographic approach, this study also used a literature review and a descriptive qualitative methodology. The Miles and Huberman method, which entails data reduction, data presentation, and conclusion drawing, is used in the data analysis process. The study's findings revealed the concepts of a flat shape, spatial geometry, and congruence. The results of this study can be used as learning aids and approaches to learning mathematics.

Keywords: Ethnomathematics, Roof, *Siwaluh Jabu*, Karo Traditional House

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PRELIMINARY

Because visual learning is simpler to understand than repetitive learning, mathematics instruction should tie mathematics to daily life. Safitri (2021) argues that as mathematics has been ingrained in people's culture, education in the subject should be relevant to daily life. Reading, writing, and counting are essential skills for all humans. Learning math is one approach to make those better. The logic of shape, composition, magnitude, and related ideas is the subject of mathematics. As a result, it is essential that students comprehend the subject of mathematics (Mahendra & Hasanah, 2023).

The idea that math is only a kind of entertainment and nothing more than a bunch of calculations, games, and equations that cause students to become confused is that math is still tough, intimidating, and uninteresting for students (C. Febriyanti, 2019). Teachers must be able to relate learning activities to the environment in order to make it simpler for

students to understand mathematical information by fusing cultural components with mathematics (D. Febriyanti & Afri, 2023). This will help to reduce these unfavorable perceptions. Even in the technical and digital age of today, mathematics is still crucial to practically every element of human life (Siregar & Restati, 2017). According to the author, not many teachers incorporate learning from daily life. As a result, the author aims to do study in an area known as ethnomathematics, which connects culture and mathematical education. The roof of the Karo traditional house "*Siwaluh Jabu*" in this study contains cultural components that are related to the idea of mathematics.

Education and culture share a tight relationship with daily life since culture as a whole is an entity that profoundly affects social life, whereas education is a basic requirement for all facets of people's existence. Ethnomathematics is one way to link culture and education. Aiming to dispel the notion that mathematics is rigid, culture-based learning in mathematics is one of the innovations (Herawaty, Widada, Novita, Waroka, & Lubis, 2018). When learning about something interesting, like culture, learning about mathematics becomes more flexible. This will promote increased research of the culture connected to mathematics as a learning process component, or what is known as ethnomathematics (Mahendra & Hasanah, 2023).

Math that is influenced or founded on culture is referred to as ethnomathematics (Andriono, 2021). It is also said that all formal mathematics education is a process of cultural interaction and each student experiences various cultural conflicts in the process, because formal education is a social institution that is unique from others, allowing intercultural socialization, ethnomathematics can also significantly benefit the mathematics learning process (Wati, Mutamainah, Setianingsih, & Fadiana, 2021). Every area of daily life will be strongly tied to mathematical content, according to a concept in ethnomathematics (Atmaja, Made Dharma, 2022). Mathematical concepts can be developed through cultural activities through ethnomathematics (Wahyuni & Pertiwi, 2017). Then, as a resource for studying mathematics that uses culture as a teaching tool, ethnomathematics acts as a link between culture and education. In terms of ethnicity, race, culture, and customs, Indonesia is diverse. Traditional houses are one aspect of culture that is directly tied to educational values (Maharani & Maulidia, 2018).

Numerous academics, like Safitri et al. (2021) have conducted ethnomathematics study on traditional house structures about Exploration of Ethnomathematics in Uma Lengge Traditional Buildings. Research Kurino & Rahman, (2022), Exploration of Panjalin Traditional House Ethnomathematics on Basic Concepts of Geometry in

Elementary School. Research Ethnomathematics in the Culture of the Ogan Komering Ulu Traditional House in South Sumatra, Sari et al., (2018). The semiotic significance of the symbols, ornaments, and carvings on the roof of the Karo *Siwaluh Jabu* traditional house is examined in a study by Syafindra et al., (2019) titled " Makna Semiotik Atap Rumah Adat Karo *Siwaluh Jabu*." The study " Kajian Ragam Hias Pada Rumah Adat Karo Ditinjau Dari Etnomatematika " by Halim (2022), then looks at the decorative variety in Karo traditional homes that incorporates mathematical aspects. While the "*Siwaluh Jabu*" roof design of the Karo traditional house is the primary subject of this study. This study differs from others in that it places a strong emphasis on students' comprehension of flat and spatial shapes, whereas the prior study did not. In the previous study, only flat and space shapes were considered. As a result, the author is keen to raise this title in order to create a learning model that takes an ethnomathematics approach.

Numerous earlier studies have produced ethnomathematics, but few authors have observed ethnomathematics on traditional roofs of buildings. Therefore, this study is considered to be novel in the field of ethnomathematics. The goal of this study is to develop a methodology for teaching mathematics. As a result, the author hopes that both teachers and students will find this research to be a useful tool or approach to the mathematics learning model.

The Karo tribe, especially in Lingga Village, has a traditional house "*Siwaluh Jabu*" which is still preserved thus it is nicknamed the Lingga Cultural Village (*Desa Budaya Lingga)*. According to Surbakti et al. (2023), the meaning of *Siwaluh Jabu* is an eight-family home where each family has a specific function. Ardianto Halim (2020), on the other hand, claims that *Siwaluh Jabu*, a traditional Karo house that translates to "large house consisting of eight parts and the head of the family," indicates that eight families are housed in this traditional Karo structure. Thus, it may be inferred that "*Siwaluh Jabu*" is a substantial structure inhabited by up to 8 families, each of which has a certain duty. Initially, the Karo people lived in small, simpler-shaped houses (*Siwaluh Jabu*) that could only accommodate one family and were built via cooperative efforts. The traditional home "*Siwaluh Jabu*" is thought to be a residence for ghosts by the locals. The group grew over time until they started to construct a sizable traditional house (*Siwaluh Jabu*) that could house numerous families. Traditional houses called "*Siwaluh Jabu*" include three basic components: the roof, the body of the building, and the foot of the building (E. A. Halim, 2022).

Figure 1. Traditional House Then

Figure 2. Traditional House Now

The roof of the Karo traditional home, according to Sitanggang (1991), is composed of flat shapes in the form of trapezoids and triangles on the roof cap, known as lambe-lambe (ayo = face of the house). At either end of the roof, there are statues of buffalo heads or horns (Simalem, 2014). The house's sloping walls, which are supported by many kitchens and have a trapezoidal shape like the roof, are similarly positioned on poles. So that the building appears robust, the supporting poles in the house serve as the primary guardians (Sitanggang, 1991). This project aims to investigate the mathematical ideas in the "*Siwaluh Jabu*" roof design of Karo traditional houses as a method of teaching mathematics at the school level in an effort to incorporate cultural components in mathematics learning.

METHODS

This study uses an ethnographic method and is descriptive in nature. According to Zayyadi (2017), the ethnographic technique is used to describe, examine, and concentrate on cultural, ethnic, and socioeconomic studies of society in more depth (Khairunnisa, Salamah, & Ginting, 2022). The mathematical concept in the roof design "*Siwaluh Jabu*" of the Karo traditional house in Lingga Cultural Village, Simpang Empat District, Karo Regency, North Sumatra, is the subject of ethnomathematics in this study. From February 12, 2023 at 10:00 WIB through February 26, 2023, the research was conducted. Researchers used observation, interviews, documentation, and literature reviews as data gathering methods. Mr. Muhammad Yamin Sinulingga, a local traditional leader, served as the study's subject, and students took part in interviews to learn more about their perspectives on education in the Lingga Cultural Village. In order to gather the information

and data required for the study, interviews were performed utilizing predetermined interview criteria. The Karo traditional house's roof was photographed from the front, back, right side, and left side as the method of documentation for this study. Literature obtained through journals and books related to ethnomathematics. On the "*Siwaluh Jabu*" roof of the Karo traditional house, data in the form of the most recent photos were utilized to evaluate the idea of school-level mathematics.

This study makes use of the reduction, display, conclusion and verification data analysis procedures developed by Miles and Huberman (Putri, 2017). Filtering, categorizing, and reducing the rough data derived from the findings of field notes is known as data reduction. The stage of assembling the data or information acquired to analyze the outcomes is known as data display. While researchers derive conclusions by summarizing the outcomes of the ongoing growth of information acquired (Rijali, 2019).

To serve as the site of researchers doing research, researchers made field observations. Create a list of tools to use as interview guidelines after that. The next step is to choose the source (respondent), which will be a traditional leader from the Karo tribe and ten students, and plan a time to interview them. Continue gathering information by going immediately to the site of the study with students, speaking with the appropriate sources, and obtaining the information or data the researcher need. Then, while conducting the interview process and taking images of the roof of the "*Siwaluh Jabu*" Karo traditional house as the subject of research, conduct documentation by recording sound and photographing sources with researchers. The researcher then makes conclusions from the information gathered through observation, interviews, and documentation.

RESULTS AND DISCUSSION

The Lengkong traditional house's roof is where researchers Yuningsih et al. (2021), claim to have discovered the concept of mathematics. The author draws the conclusion that the typical Karo house's roof also incorporates mathematical ideas. According to the author's research, the "*Siwaluh Jabu*" Karo traditional house's roof design incorporates fundamental mathematical ideas including flat shapes, spatial geometry, congruence, and similarity. These math ideas are included in it:

1. Plane

   A geographic shape known as a "plane" has dimensions like width and area (Safriyanti & Yahfizham, 2023). The "*Siwaluh Jabu*" Karo traditional house's roof is made out of the following planes: triangles, squares, rectangles, and trapezoids.

Figure 3. Rooftop

The roof of the house's upper portion has a triangle-shaped pattern. A triangle is a component of a flat, three-sided form. The narrator claims that the roof of the house's upper portion is an isosceles triangle with variable-sized sides. Because the "*Siwaluh Jabu*" Karo traditional house's roof size is customized to the preferences of each community.

Figure 4. Rooftop Ornament

In **Figure 4.** A plane rhombus can be seen. A rhombus is defined as a quidrilateral (a four-sides polygon, having four sides and four corners) whose four sides all have the same length.

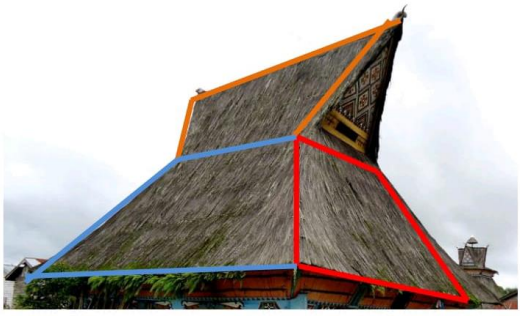


Figure 5. A whole Roof

In **Figure 5.** There are six isosceles trapezoids plane, 4 trapezoids on the lower roof, 2 trapezoids on the upper roof, each two trapezoids on the opposite side

has the same size. Isosceles trapezoid is a plane with four sides in which the top and bottom sides are parallel, while the remaining two non-parallel sides have the same length.

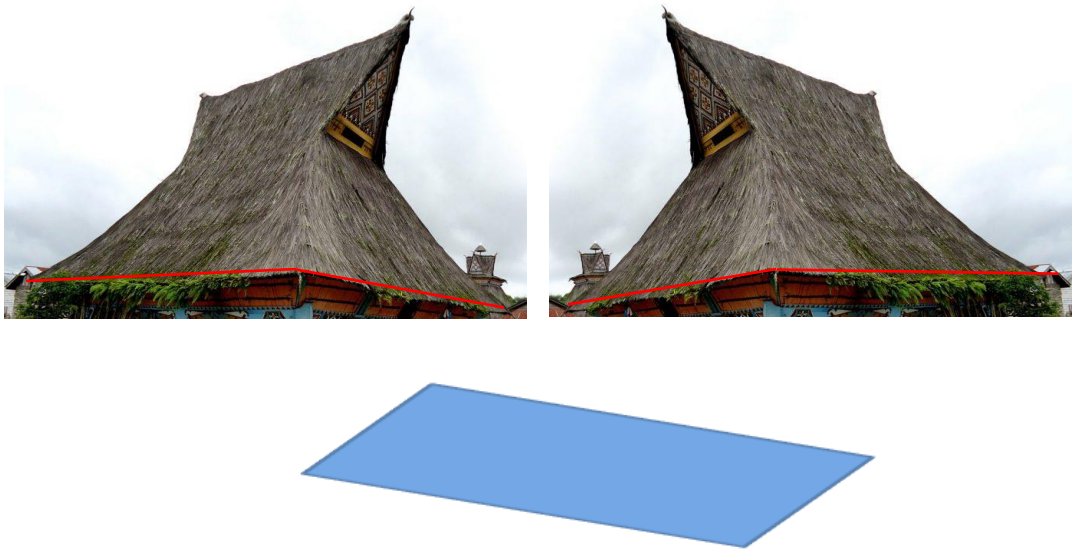
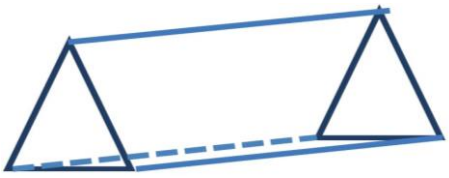


Figure 6. Lower End of The Roof

Figure 6 depicts a rectangle plane. A rectangle is a four sides plane with four right angles.

2. Geometrical Space

Front view Back view



Gambar 7. Roof Cover of Karo Traditional House

In **Figure 7.** An illustration of the geometry of a triangular prism-shaped space is the roof cover on a typical Karo dwelling. Typically, there is a volume in the wake of space (Diniyati et al., 2022). The triangular prism space has the

following unique features: a triangle base and the same shape as its roof. Three rectangles and two triangles make up the prism's entire upright side, which is rectangular in shape. A triangular prism has nine edges in total. Edges that are parallel and of equal length that are upright (Ardiansyah et al., n.d.)

3. Congruences

Wahyu (2018) asserts that two plane are said to be congruent if their sides are equal in length and angle. Agustian (2023) also emphasizes this in relation to the two requirements for congruence, namely:

Tabel 1. Conditions for Congruences

No.	Conditions for Congruences
1.	Has equal angles
2.	Have the same or corresponding side lengths and shapes

On the top of the Karo house, the author discovered congruence. As shown in the figure 8, the upper roof has congruence on the triangle plane while the lower roof has congruence on the trapezoidal plane:

(a)

Front view

Back view

(b)

Front view

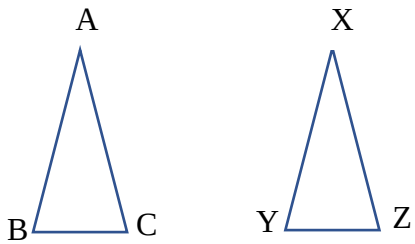
Back view

(c)

Front view Back view

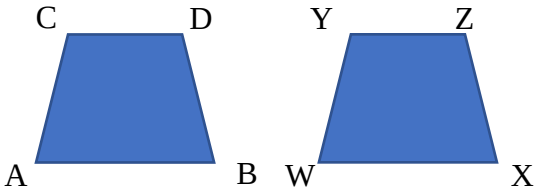
Figure 8. Roof of Karo Traditional House

In **Figure 8(a)** It can be seen that there is congruence in the isosceles triangle. If illustrated to be:



The illustration above fulfills two conditions for the congruence of a flat shape which has angles and sides of equal length, such as $\angle ABC \cong \angle XYZ, \angle BAC \cong \angle YXZ, and\ \angle BCA \cong \angle YZX$. Side length of $AB \cong XY, AC \cong XZ, and\ BC \cong YZ$. It is therefore evident that **Figure 8(a)** is congruent.

Figure 8(b) and **8(c)** can be illustrated as follows:



In the illustration above, it can be proven that there is congruence between the angles and sides such as:

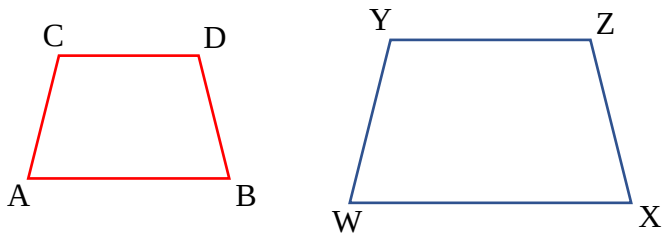
$\angle ABD \cong \angle WXZ, \angle BDC \cong \angle XZY, \angle DCA \cong \angle ZYW, and\ \angle CAB \cong \angle YWX$. Side length $AB \cong WX, AC \cong WY,\ BD \cong XZ\ and\ \angle CD \cong \angle YZ$. It is evident that **Figures 8(b)** and **8(c)** are congruent.

4. Similarity

Agustian (2023) asserts that equality consists of two planes that satisfy the two requirements of having comparable angles and having the same ratio between the two planes. According to the following Figure:

Figure 9. The Lower Roof of Karo Traditional House

In **Figure 9.** The front portion of the typical house's roof is 8 meters long, according to the source. The side measures roughly 12 meters in length. It must have equivalent angles and corresponding sides in accordance with the equality formula. Consequently, it can be demonstrated as follows:



In the illustration above, the angles and sides of both Figures match. Side of $AB \sim WX, CD \sim YZ, AC \sim WY, and\ BD \sim XZ$. Therefore, **Figure 9.** can be said to be a Similarity

According to the studies mentioned above, some mathematical ideas can be used as learning tools in the classroom. The appearance of creative and inventive learning can then be created (Hasibuan & Br Ginting, 2021). Students have various advantages from learning mathematics in cultural contexts, including an increase in their intellectual, social, and emotional intelligence as well as their cultural awareness ((Mahendra & Hasanah, 2023). In order to approach education in the way the author would want, a picture or model of a traditional Karo house's roof could be displayed in the classroom by the instructor. The teacher next instructs the class to name the image or duplicate of the traditional Karo house's roof.

Suhartini (2017)asserts that critical thinking is crucial for bridging the gap between culture and mathematics. In his study, he looked at three factors that aid students in critical thinking when studying geometry using an ethnomathematics approach: interpretation,

analysis, assessment, and decision-making. As a result, scholars attempt to use ethnomathematics to construct a mathematical strategy.

This study places a strong emphasis on teaching students to evaluate educational media critically. Because things are a real necessity in the realm of education, especially when it comes to learning mathematics. Harahap & Nurlaelah (2023)'s research takes a mathematical technique but also focuses on the distinctiveness of the roof of the Karo traditional house. However, the mathematical notion is not completely articulated. While this study reveals that there are similarities and congruences with the "*Siwaluh Jabu*" roof style of the Karo traditional house. The research's shortcoming is the dearth of participants who could provide information on the "*Siwaluh Jabu*" origin. The author then encountered costs during the study procedure due to the research location's great distance from the author's home.

CONCLUSION

It is clear from the explanation above that there is a relationship between culture and the idea of learning mathematics. The study identified several mathematical ideas, including the idea of flat buildings, the idea of space geometry, congruence, and similarity on the roof of the typical "*Siwaluh Jabu*" Karo home. ln order to use this research as a tool for teaching mathematics at the school level.

Other mathematical ideas, such the idea of angle points, the idea of lines on a plane, the idea of cut lines, and others, can be explored in this inquiry. This seeks to draw readers to the author's evolving media created for this subject. This study can help students locate math concepts in math learning materials by encouraging them to think critically. As a method of teaching math, utilize a figure or duplicate of the "*Siwaluh Jabu*" Karo traditional house's roof.

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