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Ethnomathematics Exploration of Malay Traditional Clothing Patterns in the Concept of Two-Dimensional Plane Figure

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Abstract

Ethnomathematics is a field that studies how people from different cultures understand, interpret, and use mathematical concepts. Traditional clothing is one of the cultural characteristics of the local community. The motifs on Malay traditional clothing depict symbols, ideas, and techniques of plane figures, often used intuitively by seamstresses. These motifs can be found in various Malay traditional garments and have a connection to ethnomathematics, particularly in measuring activities and mathematical concepts based on two dimensions. Therefore, the purpose of this study was to explore the elements and concepts of plane figures in Malay traditional clothing patterns through an ethnomathematics perspective. This research employs qualitative methods, with data collection conducted through observation, interviews, documentation, and literature review. The study was exploratory in nature, utilizing an ethnographic approach. The findings reveal that the motifs in Malay traditional clothing patterns, which include elements and concepts of two-dimensional shapes such as rhombuses, circles, triangles, and squares, can serve as a valuable learning resource for understanding two-dimensional geometry.

1. Introduction

According to Act No. 20 of 2003, education is a conscious and planned effort to create an environment and a learning process that enables the student to actively develop his or her potential to possess the spiritual powers of religion, self-control, personality, intelligence, noble morals, and skills necessary for themselves, communities, nations, and nations. John Dewey states that education is a process of cultivating essential basic abilities, which relate to the mental (intellectual) and emotional (emotional) powers, which produce human habits and nature. Mathematics is a type of knowledge that derives from social and cultural interactions and is used to solve problems using logic. All its components are theorems, definitions, axioms, proofs, problems, and solutions (Darmayasa & Hutauruk, 2018).

Culture consists of a series of ideas, actions, and results of diverse human work in life in a society acquired through learning. (Sutardi, 2009). The blend of culture and mathematics is something that is very beneficial to life when combined. Mathematics has always been related to every aspect of social interaction around the world. Making mathematics learning real and relevant to students is by associating mathematical concepts with their culture or context of life, which originates from their descent culture.

Ethnomathematics studies how mathematics interacts with various cultural practices. (Lubis et al., 2021). The field of research known as "Ethnomathematics" sees mathematics in the context of phenomenal culture. The mathematics used by a particular society or community combines cultures (Aditya, 2018). However, not about a particular race or community, Ethnomathematics is mathematics developed by farm workers, social groups, students from a particular region (Harahap & Rakhmawati, 2022).

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The definition of ethno in language covers all social and cultural aspects, such as language, code of behavior, myth, *jargon*, and symbols. Explaining, knowing, or understanding, and performing actions such as coding, measuring, explaining, drawing conclusions, and modeling are all meanings of the word "*mathema*". Technique comes from the word "techno", which means "technical". D'Amborsio, a Brazilian mathematician, began to use the term "Ethnomathematics" to describe the mathematics used by certain cultural groups in indigenous, labor, urban, or rural societies.

Sahertian said that exploration is an action carried out as part of the learning process and refers to research (search) with the aim of collecting data to produce new forms of simulation in order to acquire more knowledge about circumstances or objects (Kholifatuzzuhro et al., 2020).

Indonesia is an island country with many cultures, one of which is customary clothing. Over time, customary Indian clothing has become less known because of insufficient learning media and not attractive. Traditional clothing is clothing that shows identity and can be associated with a territory or period of time in history. Clothes can also indicate a person's social status, religion, or friendship. If clothes indicate the culture or identity of a particular ethnic or tribal group, they are usually referred to as tribal customs.

A community known as the Malay tribe lives in North Sumatra. Some rituals and cultures of the Malay tribe include languages, clothing, weddings, dances, and other important events that require custom. Traditional clothing is part of a particular culture of society.

The Malay tribe is a group of communities in North Sumatra. The tribal ancestry influences language, clothing, marriages, dances, and other important events as rituals and cultural forms of the tribe. Traditional clothing is also a cultural feature. Malay costume is a representation of the culture and culture of dress, has a symbolic value in the field of dressing, special clothing that is filled with meaning and used according to the conditions and times, as well as the purpose when used (Husnah et al., 2023).

Particularly in the custom dress of the bride, the custom garment of the Malay bride not only serves as a body decorator, but also as an accessory of a custom wedding ceremony. The custom bride dress is one of the factors that distinguishes a group of society from the others. For the Malay people, clothing also serves as an *aurat* cover and protector of the body from heat and cold, also signaling the symbols. These symbols embody the noble values that are upheld by the community.

Figure 1. Malay custom clothes

The bridesmaid's dress is licked with a long lash with a lash. It is a long and large *songket* or gold-coloured ornamented beads with a Melayu motif on the chest, neck, wrist, and underneath of the shirt. The colours used on the long beads can be customized to the colour used in the bride. This Malay bridal dress has undergone rapid development and has been influenced by a wide range of cultures from outside, including the use of Indian brokade fabrics, the change of silhouette, the body-forming, the shorter length of the shirt, and the addition of tails to the clothes.

Figure 2. Malay bride dress

Based on the above description, this study aims to dig further into the cultural potential and the mathematical-cultural relationship in mathematics learning. Ethnomathematics is an effective way of learning mathematics in two dimensional materials because the mathematical concepts contained in the customary dress of the bride can attract the attention of students to deepen a mathematic concept and not just stick to books and writing alone. The ethnomathematical concepts seen in Malay customary clothing are found in the patterns of the woven fabric pattern. The ethnomathematics contained in clothing patterns are plane figure geometries. A plane figure is one of the discussions in geometry about two-dimensional shapes or just having a space but not having a volume. Plane figure include: square, quadrilateral, circular, horizontal, triangular, and so on.

Previous research in the field of ethnomathematics on Malay culture has been done by Khairunnisa and Ginting (2022). The main difference between the research carried out with previous research lies in the focus of cultural elements, the main focus in previous research was to research about the Halls that exist on Malay Culture. In the ongoing research, the author investigated the patterns of Malay custom bride dress. Due to the importance of the introduction of Malay culture through the study of Ethnomathematics, researchers are interested in doing an ethnomathematical exploration of Malay customary clothing. (Khasanah et al., 2021).

In this study, the purpose of this study is to explore the elements and concepts of plane figure in Malay traditional clothing patterns through an ethnomathematics point of view. The view researchers explored the mathematical concepts that exist in every element of Malay bride costume. Thus, the mathematical concepts contained in Malay custom wedding dress can be applied to support mathematics learning at school.

2. Methods

The method of research used were qualitative research with an ethnographic approach. Ethnography is a qualitative process of describing, analysing, and understanding parts of a particular cultural group, such as patterns of behavior, beliefs, and languages. (Creswell, 2012). The study investigates the use of the concept of plane figure on the Malay Bridal Custom Clothing Pattern.

The research used qualitative research design with techniques of collecting data directly from objects involved in the research environment through in-depth field studies conducted in the field through interviews, observations, and documentation. Data sources can be records, interviews, field observations, and other sources (Rijali, 2018).

When the researchers did the observations, the cameras were used to take some photos of clothes and also interview the museum keepers during the study. During data collection, such as interviews and observations, handheld phones record voices. The research location is at the Langkat Regency Regional Museum located in Pekan Tj. Pura, Tj.Pura District, Langkat Regency. However, information collected

from the source or museum keepers is recorded with writing tools such as pencils, books, and pencils. Researchers use observations, interviews, and documentation.

One important step in research is the data collection technique, which aims to gather information. Researchers have to use this technique to gather research data as it will be used as a basis for creating research instruments. Data analysis techniques are used after all data collection techniques are concluded by word-setting in expanded text (Saleh, 2017).

The researchers gathered data verbally enriched and deepened with the results of vision, hearing, prescription, and vivacity from the researchers who ignored the various patterns that exist on the customary garments of the Malay bride. In this study, the researchers created a data collection instrument consisting of the main instrument and the auxiliary instrument. The validity of the data is used in qualitative research to assure that the data obtained is correct and relevant and has no significant defects.

3. Results & Discussions

Researchers are looking for alternative learning to overcome the desired learning outcomes. One of the learning alternatives that can be used by teachers to improve learning outcomes is to use learning models that are interesting to students and able to improve learning outcomes, one of the interesting models carried out for learning mathematics material on plane figure is to use the model of listening, observing, and feeling, through this model it is felt that it can be useful in providing shadows to students about plane figure so that the concept of plane figure can be easily mastered and student learning outcomes are improved. This is quite useful in the teaching and learning process and can introduce collaboration between cultures and education (Prakoso & Rahmatunnisa, 2019).

This Ethnomathematics study is an analysis of the mathematical activity contained in Malay customary clothing. Based on the results of explorations, observations, interviews, and documentation, Malay Custom clothing has some forms of plane figures. In this discussion is presented the plane figure forms on the pattern of Malay custom dress, and the mathematical concept that explains the forms.

3.1 Two-dimensional plane figure on Malay custom clothes patterns

Motives depicting emblems, ideas, and plane figure techniques used accidentally by seamstresses can be found on Malay custom bridal clothes. These motifs are related to ethnomathematical research, measuring activity and some mathematical concepts that are plane figure.

3.2 Triangle

These triangular patterns are found in Malay custom bridal clothes and can be associated with the concept of two-dimensional plane figure.

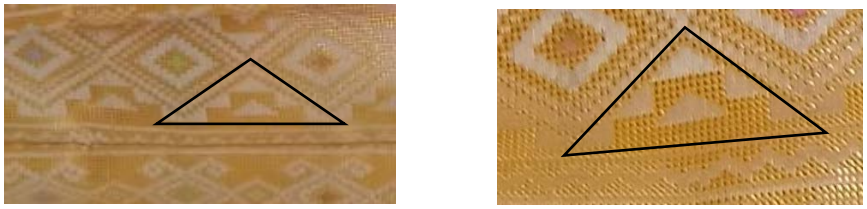

Figure 3. Triangle-shaped Malay bridal dress pattern

The custom clothing patterns found in figure 3 can be modeled geometrically. From the image, it can be seen that the modeling is in the form of a triangular two-dimensional plane figure. Based on the results, the researchers further analyzed the concept of a two-dimensional plane figure of the same side triangle on the pattern of the dress in figure 4.

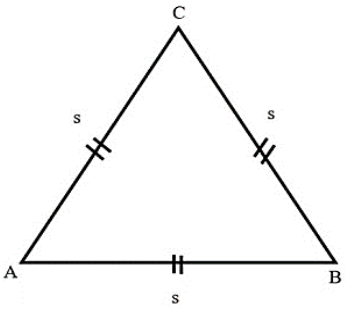

Figure 4. Concept Equilateral Triangle

Based on the analysis in Figure 4, it can be concluded that there is a concept of a triangle of equal sides on the customary patterns of the garment. In geometry, an isosceles triangle is a triangle that has two sides of the same length.

And has the same side triangle properties that can be found on customary clothing patterns according to Figure 4 which is as follows:

1. The three sides are the same length (CA = AB = BC)
2. The three angles are the same size ($\angle A = \angle B = C = 60°$)
3. Have three folded symmetries

3.3 Rhombus

The next pattern of custom clothing in figure 4 can be modeled geometrically. From the figure, it can be seen that the modeling is a plane figure with four sides.

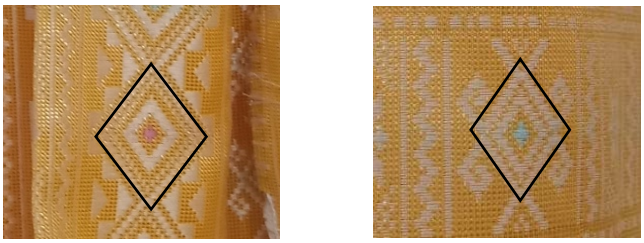

Figure 5. Clothes patterns in the shape of a Rhombus

Based on the results, the researchers further analyzed the concept of plane figure on a shirt pattern.

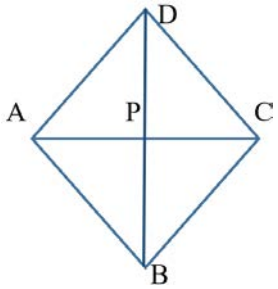

Figure 6. Concept of Rhombus

Based on the analysis in figure 6 it can be concluded that there is a concept of a square on this pattern of clothing. A triangle is made up of triangles with the same legs and shadows reflected on the side of the base in a symmetrical way. Can be seen in the figure 6 concepts of Rhombus, the four sides have the same length i.e.:

AB = BC = CD = AD and AB // CD ; AD // BC

If two angles face to face are equal in size and divided by their diagonals into two angles of equal length, then they are both perpendicular to each other.

$\angle ABC = \angle ADC$
$\angle BAD = \angle BCD$
$\angle A_1 = \angle A_2 = \angle C_1 = \angle C_2$
$\angle B_1 = \angle B_2 = \angle D_1 = \angle D_2$

Therefore, this is already in line with the criteria on the definition then it is true that this plane figure.

3.4 Parallelogram

In addition to the shaped concepts of Rhombus parts, the patterns found on the customary dress of the Malay bride were also found in the concept of plane figure of other quarters. Figure 7 below shows that there is a Parallelogram concept in this customary dress pattern.

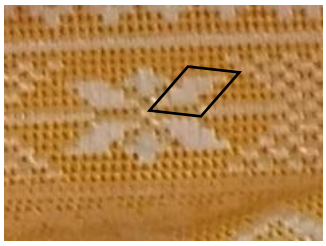

Figure 7. Parallelogram

The motif on the dress pattern there is a Malay bride in the figure above can be modeled geometrically. From the figure, it can be seen that the modeling is designed to build a two-dimensional plane figure that has four sides. Based on the available results, the researchers further analyzed the concept of two-dimensional plane figure Parallelogram on clothing patterns as follows:

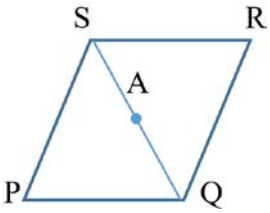

Figure 8. Concept of Parallelogram

Based on the analysis of the concept, it can be concluded that there is a Parallelogram concept in the custom dress of the Malay bride. As for the properties of the Parallelogram that can be found on the customary dress pattern of the Malay woman's bride according to the following:

1. $PQ \neq RS$; $QS \neq PS$ (Side to side)
2. $\angle P = \angle S; \angle Q = \angle R$ (Angle face-to-face)
3. $m\angle P + m\angle Q = 180°$
   $m\angle Q + m\angle S = 180°$
   $m\angle S + m\angle R = 180°$ } (One-sided angle)
   $m\angle A + m\angle P = 180°$

3.5 Square

In customary bridal dress belt accessories, researchers also found the concept of a plane figure that has four sides. Based on this, the researchers further analyzed the concept of plane figure.

Figure 9. Accessories of Square

On custom clothing accessories found in figure 9 can be modeled geometrically. From figure, it can be seen that the modeling is in the shape of a two-dimensional plane figure. Based on the available results, the researchers further analyzed the concept of two-dimensional plane figure on accessory patterns custom clothes.

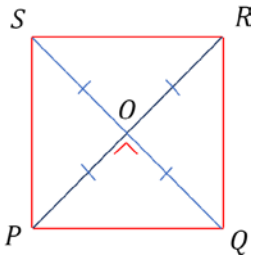

Figure 10. Concept of Square

Based on the analysis of the concept of square then it can be concluded that there is a concept of the square on the accessories of Malay custom clothing. The square is a two-dimensional plane figure, with four sides of the same length, and four angels, all of which are the square of right angels; and the square of the four is the four-sided one.

As for the properties of the square that can be found on the customary Malay dress patterns according to the concept of square is as follows:

1. PQ = QR = RS = SP
2. $m\angle P = m\angle Q = m\angle R = m\angle S = 90°$
3. PO = OR = QO = OS → QS dan PR ⊥ QS
4. It has four rotating and four folded symmetries, so it can occupy the frame in eight ways.

3.6 Rectangle

In addition to the rectangle shape, the plane figure that exists in the next bridal wear pattern is a rectangle.

Figure 11. Rectangular clothing pattern

It can be seen in Figure 11 that it can be modeled as in the concept image above. From the figure, it can be seen that the researcher analyzed the concept of plane figures.

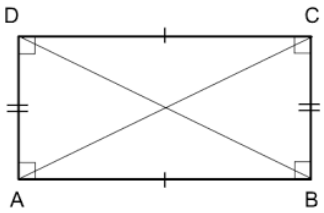

Figure 12. Concept of Rectangular clothing pattern

Based on the analysis of the figure above, it can be concluded that there is the concept of plane figures. The properties of rectangles that can be found in the modeling of clothing patterns are as follows:

1. $AB \neq CD$; $BC \neq AD$
2. $m\angle A = m\angle B = m\angle C = m\angle D = 90°$
3. Has 2 rotary symmetries and 2 fold symmetries.

3.7 Circle

In addition to the circle shape, accessories on Malay custom clothes can also be modeled geometrically so that it can be concluded that there is a concept of circles on Melayu custom clothing in figure 13.

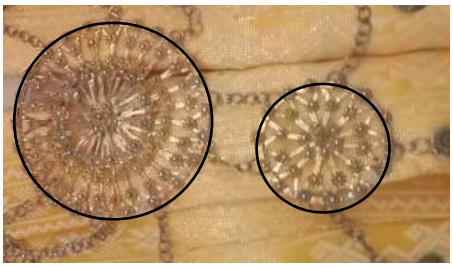

Figure 13. Accessories of circle

It is seen in Figure 13 that geometrically it looks like building a flat circle. It can be seen that the concept of a two-dimensional plane figure is circular. A circle is defined as a curved line that meets its two ends which means that it does not have an angle point and all the points located on the curve line have the same distance to its center point. There are several parts of a circle, namely the radius, diameter, arc, chord, sector, and segment. Based on this, the researchers further analyzed the concepts of plane figures that exist on the concept of circles.

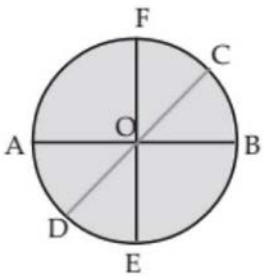

Figure 14. Concept of circle

Based on the analysis of figure 13, it can be concluded that there is a concept of circles on custom clothes. As for the properties of the circles that can be found on the model of Malay custom clothing according to Figure 14 are as follows:

1. O = The center point of the circle
2. The black line is the circumference of the circles
3. The grey area is the area of the
4. AB, DC, and EF circles is the diameter of the Circle as well as the curved line

5. AD, DE, EB, BC, CF, AF is the arc of the
6. AO Circle; BO; CO; DO; EO; and FO are the radius (r) of the Circle.

Because the criteria in the definition are already matched, it is true that this construction is a circular construction. From the results of the study, the Malay Traditional Clothing Pattern is included in ethnomathematics which can be used for learning approaches in mathematics and even cultural materials. The results of this study indicate that the motifs in the Malay traditional clothing pattern contained in the elements and concepts of plane figure such as rhombuses, circles, triangles, and squares can be used as a source of learning about flat areas. This mathematics learning can indirectly instill the values of love for culture in students.

4. Conclusion

Based on the explanation presented, it can be concluded that the motifs found in the customary bridal dress patterns contain mathematical concepts mainly on the two-dimensional plane figure material that is rhombus, triangular, square and circle. The results of the research showed that Malay custom clothing is not only a distinguishing element of a tribe, but the motifs on the Malay custom bride clothing can be used as a medium in mathematical learning. Such mathematical learning can indirectly instill values of love for culture in the pupils. A concept is an abstract idea by which objects can be grouped. In everyday life there are many forms that can be grouped into a concept like two-dimensional plane figure. In mathematical learning, two-dimensional plane figure is one of the lessons that introduces the relationship between points, lines, angles, and fields. D'Amborsio, a Brazilian mathematician, began to use the term "Ethnomathematics" to describe the mathematics used by certain cultural groups in indigenous, labor, urban, or rural societies. Therefore, it is recommended to do research on two-dimensional plane figure on other fashion. Not just fashion, but it can use other cultural elements to be used as a medium in learning mathematics. In an interview the museum keeper also said there is a mathematical concept in the range of Malay customary clothing patterns that can be applied in the learning of mathematics in schools is one of the concepts of two-dimensional plane figure.

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