EXPLORATION GEOMETRY TRANSFORMATION CONCEPT FROM SAMARINDA SARONG

Nur Fathaillah Pajrin[1], Haeruddin[2], Sugeng[3]
[1]Mulawarman Countru, Samarinda, Indonesia
[2] Mulawarman Countru, Samarinda, Indonesia
[3] Mulawarman Countru, Samarinda, Indonesia
[1]n.fatha.pajrin@gmail.com, [2]Haeruddin22@gmail.com, [3]sugeng_ppg@gmail.com

ABSTRACT

Samarinda sarong is a masterpiece or special craft that lived in Samarinda city and one of the most icon from this city. This culture should be able to give attention to the people of Samarinda, because through education based on local wisdom it is able to grow the love of students to preserve the culture in which they live. The purpose of this study is to find out geometry transformation concept that found from Samarinda sarong design in Tenun village. The research method used is a qualitative research method with an ethnographic approach. The research was conducted at Cahaya Samarinda production site in RT.07 Weaving Village with the research subject being the samarinda sarong and the object of research is the geometry transformation concept that is in the sarong motif made. Research data were collected using documentation techniques. Data analysis was carried out by reducing, presenting, making conclusions, and then presented in detail by linking supporting theories. Form explore result have found geometry transformation concepts such as translation, reflection, rotation, dilatation and some compotitions that was happened.

Keyword: Samarinda sarong, ethnomathematic, Geometry Transformtion concepts

INTRODUCTION

This research is based on two problems found from two different aspects, namely the cultural aspect and the mathematics learning aspect. From the cultural aspect, two problems were found that became a problem because the values in culture were decreasing. The first problem is the entry of foreign cultures in Indonesia. Of course, this is a serious problem for the Indonesian people, seeing the amount of food, language styles, and lifestyles that change cultural values to become weaker (Sita, 2013). While the second problem comes from technology that is developing too fast. If viewed from a positive perspective, it is certainly able to facilitate everyone's work, but from a negative side, technology that is too advanced can change the lifestyle of a person who was initially active in cultural activities to become passive, so because of this cultural values can decrease (Rahayu, Mardhiansyah, & Arlita, 2014).

In another aspect, namely learning mathematics, two problems were found. The first problem is impressive learning because the teaching and learning process is according to standards, speed and memory so that learning seems monotonous. Impressive learning also coupled with the bad experiences of students about mathematics lessons at the previous level (Siregar, 2017). The second problem is that the mathematics learning taught to students is not realistic, which means that the teacher has not provided examples or is associated with mathematics learning with other aspects, such as art or culture, social, science, and so on (Ningsih, 2014).

Based on the problems found, one of the efforts that can solve the problem both from the cultural aspect and from the aspect of learning mathematics is ethnomathematics. Ethnomathematics can be defined as the cultural anthropology of mathematics, which is a study that is directly related to the relationship between mathematics and culture that exists in a particular area (Risky Indah Yuniara, 2020).

This research has been done by several people, of course because this research seems new. The following is an example of a research similar to the title ETNOMATIKA ON MADURA BATIK. The results of this study indicate the existence of mathematical concepts that can be seen directly such as points, lines, angles and some flat shapes. However, this study also found the concept of symmetry and similarity. Both of these concepts must be discovered by doing an abstraction first and compared with the supporting theory (Zayyadi, 2017).

Another example of research is research with the title USING ETNOMATHEMATICS IN INDRAMAYU BATIK ARTS IN TRANSFORMATION GEOMETRY LEARNING. Transformation geometry is one of the materials of mathematics that requires an abstraction in order to find the concept. The results found in this study, especially geometric transformations, show the concepts of translation and reflection. However, in this study, the mathematical concepts found are linked with supporting theories, such as the definition of translation and theorem on reflection (Sudirman, Rosyadi, & Lestari, 2017).

Transformation geometry material requires abstraction first on Cartesian coordinates to make it easier to find this concept. Concepts found in certain objects must also have special requirements that are included in supporting theories so that mathematical concepts found in an object are considered more relevant and not just finding, but also linking mathematical values in it. The skills needed in this material are the ability to visualize and the ability to abstract certain objects (Karsoni Berta Dinata, 2019).

Based on several studies that only focus on finding a mathematical concept and require abstraction first and without the support of supporting theories, the researchers are interested in conducting research with the title Exploration of Geometric Transformation Concepts in Samarinda Sarongs. The samarinda sarong was chosen because the location of the cultural products was not too far from the researcher's residence. The formulation of the problem in this study is the concept of geometric transformation found in the Samarinda sarong and what theory supports the Samarinda sarong. The purpose of this research is to find the concept of transformation geometry based on the existing mathematical aspects.

The benefits that can be drawn from this research are 1) For the general public, it is to educate the public that mathematics is not only related to formulas and abstract things, but something that is real in society, 2) For the weaving village, it is to introduce mathematical concepts related to the local culture, and 3) For the teacher is able to carry out the mathematics learning process by linking it with local culture.

METHOD

The research method used this time is a qualitative research method with an ethnographic approach. This approach is taken because the researcher himself wants to explore the mathematical elements that exist in a culture. The culture addressed here is the typical culture of the weaving village, namely the Samarinda sarong. The process that must be passed is to carry out the following steps.

1. Identify the mathematical elements in the data.
2. Asking for guidance from the local regional head regarding the research to be carried out
3. Make materials / interview designs, so as not to get out of the main topic.

The place used in this study is Cahaya Samarinda, namely the house of Mr. H. Arsyad which is located in RT.07 of the weaving village. The research subject is the Samarinda sarong and the object of this research is the geometric concept of the sarong motif. With the interview technique, the research data obtained were then analyzed using Miles and Huberman's technique, namely data collection, data reduction, data display, and conclusion drawing data. To ensure that the data obtained are correct, it is necessary to triangulate sources.

RESULT AND DISCUSSION

Samarinda sarong is a masterpiece or the result of the culture of the weaving village community in Samarinda opposite. To find a place of production of this sarong in the area is not too difficult. Most of the weavers live in RT.05 and RT.07. The research data this time is located at the Samarinda Light Production site on RT.07. From the Samarinda sarong production site, the data is presented as follows.

Bontang Design

Orange Bontang design Pink Bontang design

This motif has 2 variations, namely the bontang motif with an orange base and the bontang motif with a pink base. There is no further explanation about this motif, both historical, functional, and other values.

Puple Hatta with gradation

Hatta gerangsung

Hatta declaration

This motif is dominated by a square or rectangular shape that is cut by parallel and perpendicular lines to each other. The four motifs are variations of the Hatta motif. It is not known how the original motif of the Hatta motif is. This motif is called the Hatta motif because the first Indonesian vice president had visited Samarinda.

Merica design

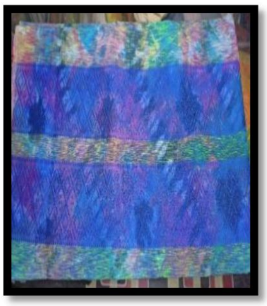
merica/pulu bolong design

Merica with combination

On the motif of black pepper/pulu bolong/sticky rice, it is not known why there are so many mentions of the name of the motif. These two motifs are not the original motif of pepper. These two motifs are new variations of the pepper motif. There is no further explanation of this motif, both historical value, use and others.

Lebba Suasa Design

The lebba suasa motif is not the original motif of lebba suasa. The original colors of the suasa leba are black, white and red. The motifs in the following picture are motifs that have been varied.



Lumut design

This motif is recognized because its dominant shape has parallel lines and many have a rhombus shape. The dominant color in this motif is blue which is given a slight gradation of green.

Country design

This motif is dominated by green, blue with white lines. This motif has similarities with the hatta and bontang motifs.

Pengantin design

This type of sarong is very rarely used in weddings in the village due to the times. Based on the research data obtained, various Samarinda sarong motifs were found, starting from the Bontang motif, the squid motif, the hatta motif, the bridal motif, the lebba suasa motif, the state motif and the pepper motif. Some of these motifs of course also experience new variations and gradations, but do not leave the characteristics of the original form. The results of research related to the sarong motif in the weaving village can be seen in the following table.

Mathematic Concept	Bontang design	Large Squid	Small Squid	Hatta Declaration	Purple Hatta with Gradation
Translation	✓	✓	✓	✓	✓
Reflection	✓	✓	✓	✓	✓
Rotation	✓	✓	✓	✓	✓
Dilatation	✓	-	-	✓	✓
Component of geometry transformation	✓	✓	✓	✓	✓

Mathematic Concept	Hatta Gerangsong	Pengantin design	Merica/Pulu bolong design	Merica with gradation
Translation	✓	✓	✓	✓
Reflection	✓	✓	✓	✓

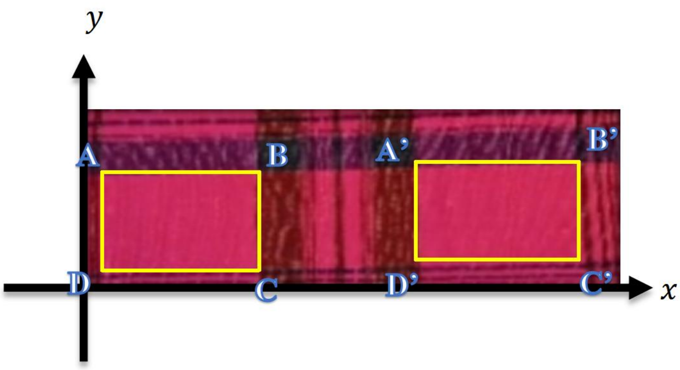
Rotation	-	✓	✓	✓
Dilatation	✓	✓	✓	✓
Component of geometry transformation	✓	✓	✓	✓

Translation

This concept happened because there some objects that made by shift primary object. The shadow of translation process won't change the size and shape from object. This concept supported by the definition that I get from ''Tangkas Geometri Transformasi", there is

> One of fuction T (Translation), if there directed line segment AB such that for every dot P apply $T(P) = P'$ and $\overline{PP'} = \overline{AB} = T_{AB}$

An example, from pink Bontang design can abstraction to cartesian coordinate. Pitcure 1 will show translation concept that happened in pink Bontang design.



Picture 1. Translation concept from design

The following is a representation obtained that picture 1.

$$T: ABCD \to A'B'C'D'$$

$$T: A \to A'$$

$$T: B \to B'$$

$$T: C \to C'$$

$$T: D \to D'$$

If this concept connected to concept matrix, so

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} a \\ b \end{pmatrix} + \begin{pmatrix} x \\ y \end{pmatrix} = \begin{pmatrix} a + x \\ b + y \end{pmatrix}$$

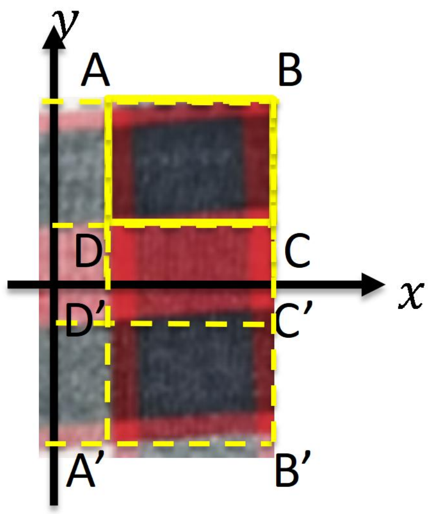
Reflection

This concept found because there are some object that happen to reflect with a line. The shadow of translation process won't change the size and shape from object. This concept supported by theorem below.

An example reflection from line g and $P(x, y) \in V$, if

1) $g = \{(x, y)|x = 0\}$ so $\mu_g(P) = (-x, y)$
2) $g = \{(x, y)|y = 0\}$ so $\mu_g(P) = (x, -y)$
3) $g = \{(x, y)|x = a\}$ so $\mu_g(P) = (2a - x, y)$
4) $g = \{(x, y)|y = b\}$ so $\mu_g(P) = (x, 2b - y)$
5) $g = \{(x, y)|y = x\}$ so $\mu_g(P) = (y, x)$
6) $g = \{(x, y)|y =- x\}$ so $\mu_g(P) = (-y, -x)$

An example, from lebba suasa design can abstraction to cartesian coordinate. Pitcure 2 will show reflection concept to axis x.



Picture 2. Reflection concept from lebba suasa design

The following is a representation obtained that picture 2.

$$M_x: ABCD \to A'B'C'D'$$

$$M_x: A \to A'$$

$$M_x: B \to B'$$

$$M_x: C \to C'$$

$$M_x: D \to D'$$

If this concept connected to concept matrix, so

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Rotation

The concept of rotation is found because some parts or objects of this motif experience repetition made by rotating the main object. The shadow from the rotation of this part of the motif will not have a different shape from its initial shape. This concept supported by definition below

$$\rho_{O,\varphi}(P) = (x\cos\varphi - y\sin\varphi,\ x\sin\varphi + y\cos\varphi) \text{ or}$$
$$\rho_{O,\varphi}(P) = \begin{pmatrix} x_1 \\ y_1 \end{pmatrix} = \begin{pmatrix} \cos\varphi & -\sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$
for $P(x, y) \in V$ and $O(0,0)$

and

$$P' = \rho_{A,\varphi}(P) = ((x-a)\cos\ \varphi - (y-b)\sin\ \varphi + a, (x-a)\sin\ \varphi + (y-b)\cos\ (\varphi + b)) \text{ or}$$
$$\rho_{A,\varphi}(P) = \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos\varphi & -\sin\varphi \\ \sin\varphi & \cos\varphi \end{pmatrix} \begin{pmatrix} x-a \\ y-b \end{pmatrix} + \begin{pmatrix} a \\ b \end{pmatrix}$$
for every $P(x, y)$ and $A(a, b) \in V$

An example, from lebba suasa design can abstraction to cartesian coordinate. Table 1 will show rotation concept with their angle.

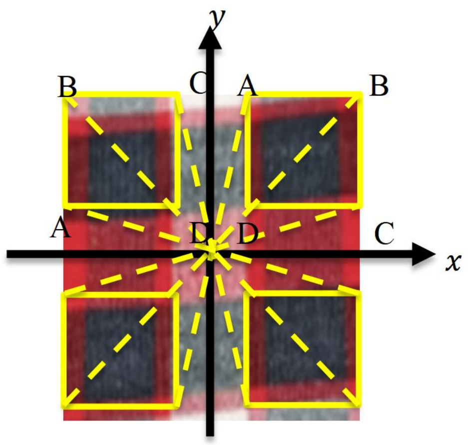
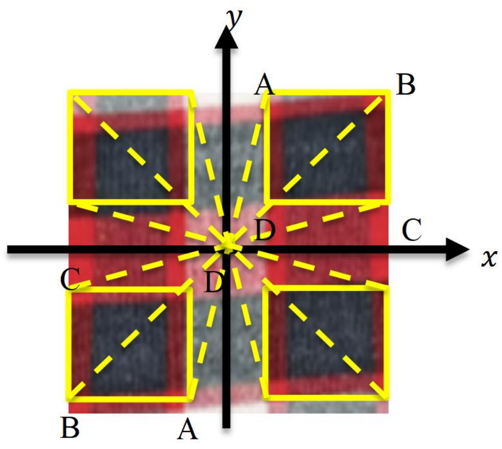
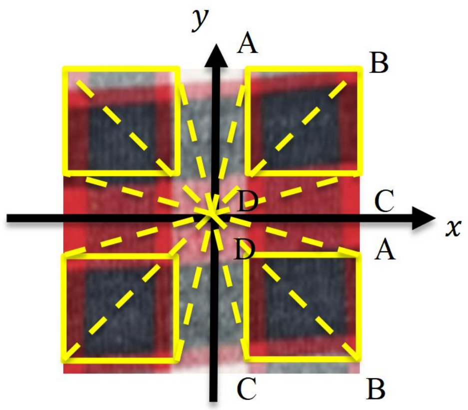
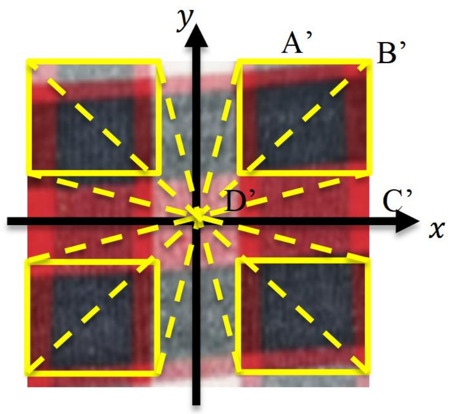
<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>Rotation with O centre and angle +90°</td><td>Rotation with O centre and angle +180°</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>Rotation with O centre and angle +270°</td><td>Rotation with O centre and angle +360°</td></tr>
</table>

Table 1. Rotation concept in lebba suasa design

Same like another concept, this concept can show to matrix by the angel that happen in lebba suasa design.

Rotation with angle =+90°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 90° & -\sin 90° \\ \sin 90° & \cos 90° \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Rotation with angle =+180°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 180° & -\sin 180° \\ \sin 180° & \cos 180° \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Rotation with angle =+270°

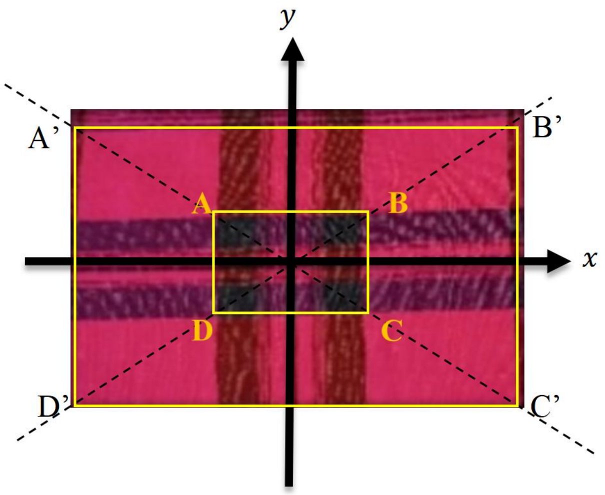
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 270° & -\sin 270° \\ \sin 270° & \cos 270° \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Rotation with angle =+360°

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos 360° & -\sin 360° \\ \sin 360° & \cos 360° \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Dilatation

The concept of dilatation was found because in the lebba motif there was a change in scale. Changes in scale or size that occur in this motif can change the size to be large or to be small depending on the existing scale factor. An example, from pink Bontang design can abstraction to cartesian coordinate. Pitcure 3 will show dilatation concept.



Picture 3. Dilatation concept from pink Bontang design

The following is a representation obtained that picture 3.

$$O(K): ABCD \to A'B'C'D'$$

$$O(K): A \to A'$$

$$O(K): B \rightarrow B'$$

$$O(K): C \rightarrow C'$$

$$O(K): D \rightarrow D'$$

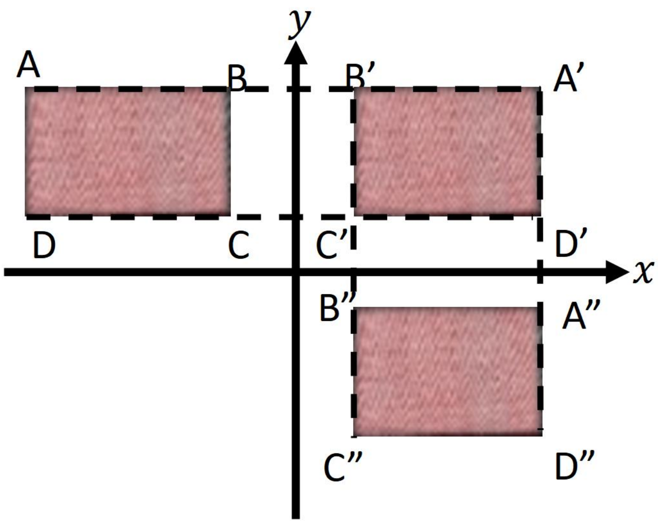
$$\text{so, } O(K): D: ABCD \rightarrow A'B'C'D'$$

If this concept connected to concept matrix, so

$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} k & 0 \\ 0 & k \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$

Compotition of geometry transformation

This concept can happen with used creativity someone that look at Samarinda sarong design. One of the most compotition by geometry transformaton is glide reflection. Glide reflection is combination of from reflection concept and continue to translation concept. An example, from Hatta declaration design can abstraction to cartesian coordinate. Pitcure 4 will show dilatation concept.



Pitcure 4. Glide reflection concept from Hatta declaration design

The following is a representation obtained that picture 1.

$$M_x: ABCD \rightarrow A'B'C'D'$$

$$M_x: A \rightarrow A'$$

$$M_x: B \rightarrow B'$$

$$M_x: C \rightarrow C'$$

$$M_x: D \rightarrow D'$$

And continue to

$$T: A'B'C'D' \rightarrow A''B''C''D''$$

$$T: A' \rightarrow A''$$

$$T: B' \rightarrow B''$$

$$T: C' \rightarrow C''$$
$$T: D' \rightarrow D''$$

CONCLUSION

Based on the analysis by linking the transformation geometry concepts found in the samarinda sarong with existing supporting theories such as definitions and theorems, it can be concluded that the transformation geometry concepts found are translation, reflection, rotation, dilation and composition of the transformation geometry. This research is expected to be able to increase creativity for students in finding other mathematical concepts by linking existing supporting theories, and it is hoped that this research will be able to cover the shortcomings of problems in mathematics culture and learning.

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