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EXPLORATION OF BATIK JAMBI ON LEARNING TRANSFORMATION GEOMETRY

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Abstract

Geometry Ability is one of the mathematical abilities that must be mastered by students, this is because geometry ability is one part of learning mathematics. However, the reality in the field in junior high school students, students have difficulty in learning transformation geometry, namely in the material of reflection, rotation, translation and dilatation. This difficulty of students is caused by students not understanding the coordinate points on the cartesian plane. The difficulty of students in determining cartesian coordinates has the effect that students cannot determine straight-line drawings based on straight-line equations. Another thing that causes students difficulty in understanding the geometry of transformation is that students' ability to think abstractly is still very low, students cannot describe concepts from mirroring, turnover, shifting and dilatation. The purpose of this study is to understand the geometry of trasnsformas through the exploration of Jambi batik. The research method used is descriptive qualitative, the result of the research obtained is that there is a concept of transformation geometry in Batik Motik Jambi so that it can be applied in mathematics learning.

Keywords: Ethnomatics, Jambi Batik, Transformation Geometry

Abstrak

Kemampuan Geometri merupakan salah satu kemampuan matematika yang harus dikuasai oleh siswa, hal ini dikarenakan kemampuan geometri merupakan salah satu bagian dari pembelajaran matematika. Namun kenyataannya di lapangan pada siswa SMP, siswa mengalami kesulitan dalam mempelajari geometri transformasi, yaitu pada materi refleksi, rotasi, penerjemahan dan dilatasi. Kesulitan siswa ini disebabkan oleh siswa yang tidak memahami titik koordinat pada bidang kartesius. Kesulitan siswa dalam menentukan koordinat kartesius berpengaruh bahwa siswa tidak dapat menentukan gambar garis lurus berdasarkan persamaan garis lurus. Hal lain yang menyebabkan siswa kesulitan dalam memahami geometri transformasi adalah kemampuan siswa untuk berpikir abstrak masih sangat rendah, siswa tidak dapat menggambarkan konsep dari mirroring, turnover, shifting dan dilatasi. Tujuan penelitian ini adalah untuk memahami geometri trasnsformas melalui eksplorasi batik Jambi. Metode penelitian yang digunakan adalah deskriptif kualitatif, hasil penelitian yang diperoleh adalah terdapat konsep geometri transformasi pada Batik Motik Jambi sehingga dapat diterapkan dalam pembelajaran matematika.

Katakunci: Etnomatematika, Jambi Batik, Geometri Transformasi

INTRODUCTION

Geometry is a study in mathematics, geometry is something that is often used in everyday life. (Huda, 2018) the study of the field of geometry is part of the educational curriculum taught from elementary to tertiary level. (Ismaniati, 2013). (Stewart, n.d.) Geometry is a concept glue that connects various fields in mathematics. Van de Walle (2008) classifies four materials in geometry, namely (1) shapes and properties that include learning

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the properties of two- and three-dimensional forms and the relationships that build from these properties, (2) transformations that include translational learning, reflection, rotation, symmetry and the concept of revival, (3) locations that refer to coordinate geometry or other ways of determining how objects are located in plane or space, (4) visualization that includes recognition of the forms of the surrounding environment, development of the relationship between two-dimensional and three-dimensional objects and the ability to describe and recognize shapes from various points of view

Geometry ability is one of the mathematical abilities that must be mastered by students, this is because geometry ability is one part of learning mathematics. However, the reality in the field in junior high school students, students have difficulty in learning transformation geometry, namely in the material of reflection, rotation, translation and dilatation. This difficulty of students is caused by students not understanding the coordinate points on the cartesian plane. The difficulty of students in determining cartesian coordinates has the effect that students cannot determine straight-line drawings based on straight-line equations. Another thing that causes students difficulty in understanding the geometry of transformation is that students' ability to think abstractly is still very low, students cannot describe concepts from mirroring, turnover, shifting and dilatation. For this reason, the ability to think abstractly must be developed in learning transformation geometry. This is supported by Schult in Albab (2014) Students have difficulty in understanding the concept of transformation including translation, reflection, rotation and combination of such transformations. In addition, students also lack understanding of how a wake is reflected or reflected. "Another difficulty that students experience is one of them has to do with the direction of transformation. The problem in understanding transformation geometry results in students' low geometric thinking skills, where Geometry thinking according to Pierre van Hiele and Dina van Hiele Geldof (1957-1959) puts forward a theory about cognitive development that students go through in learning / understanding geometry. According to his view, students will experience the following five levels of geometric thinking: (a) Level 0 (visualization). At this level, students recognize geometric shapes, which are just visual characteristics and their appearance; (b) Level 1 (analysis). At this level students have begun to become acquainted with the traits that the geometric constructs have observed; (c) Level 2 (abstraction). At this level students have begun to recognize and understand the properties

of a geometric construct that is interconnected with each other; (d) Level 3 (deduction). At this level the student has been able to draw conclusions deductively, that is, draw conclusions of a general nature and go to things of a special nature; (e) Level 4 (rigor). At this level, students have begun to realize the importance of the accuracy of the basic principles that underlie a proof (Lestari, 2015: 35).

Geometry thinking can be improved by a learning approach using geometry problems in everyday life, this daily life is closely related to culture where Indonesia is a great nation, a nation that has a lot of cultural wealth. Batik is a cultural wealth that is very proud of the Indonesian nation, the recognition of batik as a wealth of Indonesia has been recognized by the world, batik exploitation was recognized by UNESCO in 2009 batik was included in the list of human heritage objects that must be protected. Membantik becomes a culture in Indonesia, on average, each region has its own batik pattern where this batik pattern symbolizes the conditions, philosophies and cultures that exist in the area. In batik motifs there is a study of mathematics according to Lubis and yanti (2018) in batik there is Geometry. Until now in Indonesia has approximately 30 batik motifs, the batik motifs contain mathematical activities, such as symmetrical images, sizes, determining the combination and location of colors, planes, lines and points, as well as textures so as to create a complete and harmonious beauty in batik paintings that characterize its uniqueness, batik activities carried out are related to geometry. . One of the existing batik motifs is Jambi batik, jambi batik comes from the Malay Jambi Sultanate which at that time jambi batik was only used by the Jambi sultanate family, this happened because at that time it was very rare for people to be able to make jambi batik crafts. The uniqueness of Jambi batik lies in its motifs that do not form a series and stand alone, the main motifs of Jambi batik are flora and fauna, batik dyes and the materials used are also natural materials derived from various woods and plants in Jambi such as bulian wood fruit, lago wood sap, high wood pandanm leaves and sepang wood, Jambi batik motifs have distinctive characteristics that are influenced by aesthetics and philosophies based on graphic conditions, culture, beliefs and the results of arts and crafts, the pattern of the motifs is like the angso duo motif, this motif depicts 2 geese that are facing or in tandem where the philisophy is based on humans hiduup to be in harmony with sesame and must try to find a better place, Batanghari motif this motif is derived from the name of the river that

stretches through almost the entire province of Jambi, this motof has a philosophy of humans must be able to look for naiali out like a river flow, the durian motif breaks philosophically is the leader must have a mandate, be firm in speech and behavior, and provide benefits to many people. Urian motifs and philosophies of jambi batik illustrate that the Jambi people have used mathematics in distributing their culture such as determining combinations, locations, planes, lines, points on their typical batik motifs.

Mathematical research by relating to culture is known as ethnomathematics, research on Ethnomathematics was first introduced in 1977 by D'Ambrosio, who is a Brazilian mathematician. Ethnomathematics was created to describe the practice of mathematics in cultural groups that can be identified and considered as the study of mathematical ideas found in each culture (Sarwoedi, et al., 2018) Linguistically ethnomathematics comes from the word "Ethno" which is interpreted as something that refers to the socio-cultural context, such as the culture of the community, codes of conduct, myths, symbols, etc. "Mathema" is interpreted as explaining, knowing, performing activities such as coding, measuring, and inferring. And "Tics" comes from the word technewhich means Engineering. Uloko and Imoko (2007) in (Mujiasih, 2016) say that the success of the Japanese and Chinese countries in learning mathematics is because they use Ethnomathematics in their mathematics learning. (Bishop, 1994) Culture will influence individual behavior and has a large role in the development of individual understanding, mathematics learning has essentially integrated with everyday life. In order to accommodate the role of ethnomathematics in learning, mathematics teachers need to position themselves as facilitators of providing culture-based mathematics learning that can make students know the value of culture, solve problems students have difficulty understanding the geometry of transformation and can improve geometry thinking. Therefore, ethnomathematics experts argue that basically the development of mathematics until any time is inseparable from the culture and values that have existed in society, ethnomathematics research needs to get space, on the jambi batik motif can be used by students in studying transformation geometry. Based on the description above, this research is entitled "Exploration of Jambi Batik on Learning Transmutation Geometry".

METHODS

The research method used in this study is descriptive qualitative, using literature related to Jambi Culture, with an exploratory type of research that aims to explore broadly the causes that affect a phenomenon. The approach used is ethnography, which is an approach aimed at investigating and obtaining a description of an in-depth analysis of a cultural group based on field research (fieldwork) in a certain period of time intensively. This research method finds how to organize culture in learning mathematics in schools, namely the concept of transformation geometry found in Jambi batik.

RESULTS AND DISCUSSION

In this study, what was produced was philosophical jambi batik, batik motifs that contain mathematical values and geometric transformations. In the jambi motif, there are concepts of transformion geometry such as reflection, translation, rotation and dilatation. The batik center in Jambi is located in the city of Seberang Jambi, precisely in the village of Ulu gedong and Mudung laut Village with the name of the folk craft hall Selaras Pinang Masak or called the Jambi batik studio. The design of Jambi batik motifs is influenced by ancient melaytu culture, Buddhism and Islam. Jambi batik motifs show the articulation of the richness of jambi cultural treasures in the visual dimension, representing historical identity and cultural diversity in Bumi Pucuk Jambi Sembilan Lurah. Jambi batik motifs are inspired by the environment around Jambi, namely flora and faina. The famous Jambi batik motifs are Durian Pecah, Batanghari, Angso Duo Berwing, Kapal Sanggat, Kuau Berhias, Tampuk Manggis and others. The coloring was still initially used natural ingredients taken from plants in the forest in Jambi province. Mifta (2020)This natural dye produces a distinctive color that is mesmerizing and different from artificial dyes, For example, sepang wood produces a reddish-yellow color, ramelang wood produces a red-brown color, slowo wood produces a yellow color, and nilo wood produces a blue color. Some jambi batik motifs that contain ethnomathematics on the geometry of transformation are as follows:

1. **The Concept of Reflection (Mirroring)**

Figure 1. Angso Duo motif

In figure 1, it is clearly seen that there is a concept of reflection (mirroring) seen from the image of the goose shifting at the same distance as the object in the middle, with the shape of the geese facing each other.

Figure 2. Broken durian motif

In the broken durian motif, the concept of reflection (mirroring) is also seen. Draw a durian split in half of the same size, and facing the same direction.

Figure 3. Half durian motif

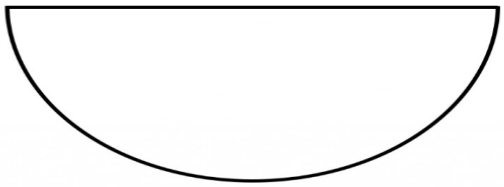


Figure 4. Semi Circle

The initial shape of the semicircle is then reflected against the x-axis so that it forms a whole but broken durian.

Figure 5. One Broken durian motif

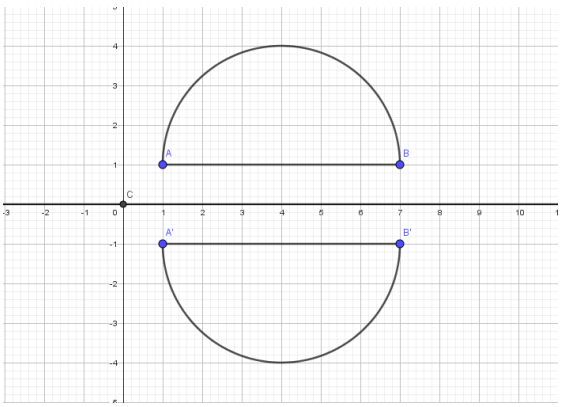
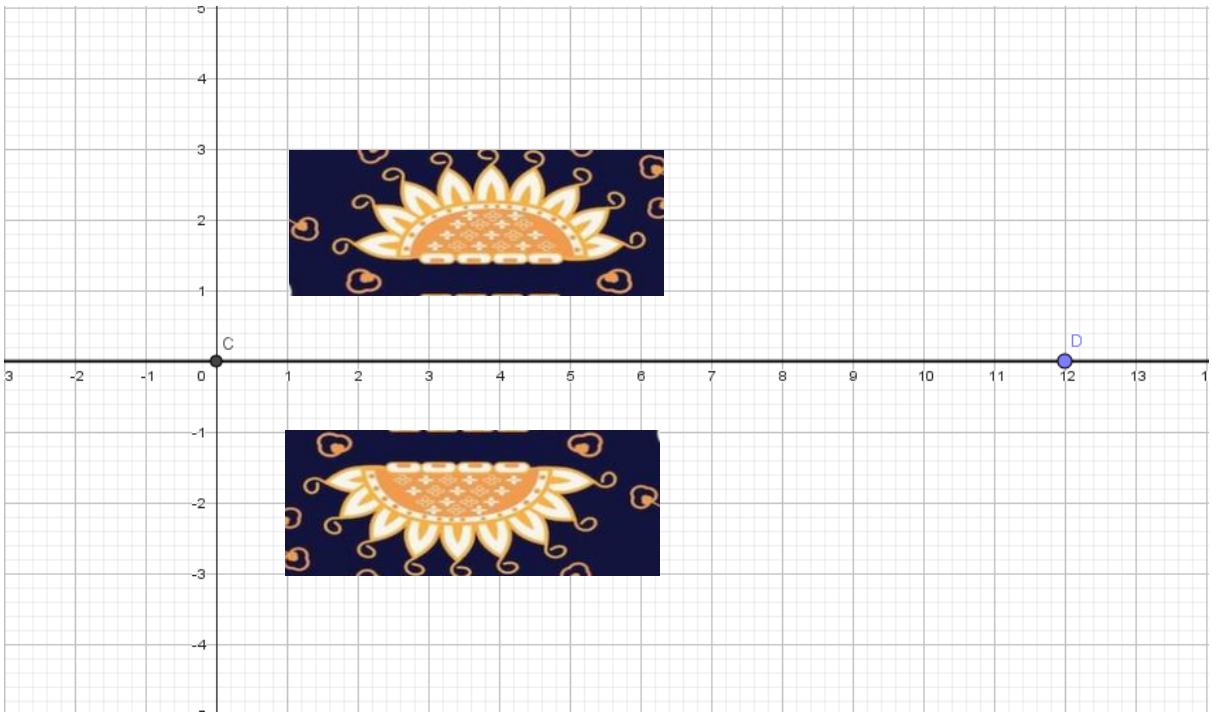


Figure 6.Circle on Coordinat Cartecius

The semicircular shape is mirrored against the x axis with points $A(x, y)$ and $B\ (x, y)$ has shadows $A'(x', y')$ and $B'(x', y')$. Then it can be written as follows: The semicircular shape is mirrored against the x axis with points $A(x, y)$ and $B\ (x, y)$ has shadows $A'(x', y')$ and $B'(x', y')$. Then it can be written as follows:

$$A(x, y) = A'(x', y') = A' = (x, -y)$$
$$B(x, y) = B'(x', y') = B' = (x, -y)$$
$$x' = x$$
$$y' = -y$$
$$(x, y) \xrightarrow{R_x} (x, -y)$$
$$\begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ 0 & -1 \end{pmatrix} \begin{pmatrix} x \\ y \end{pmatrix}$$



2. Translational Concept

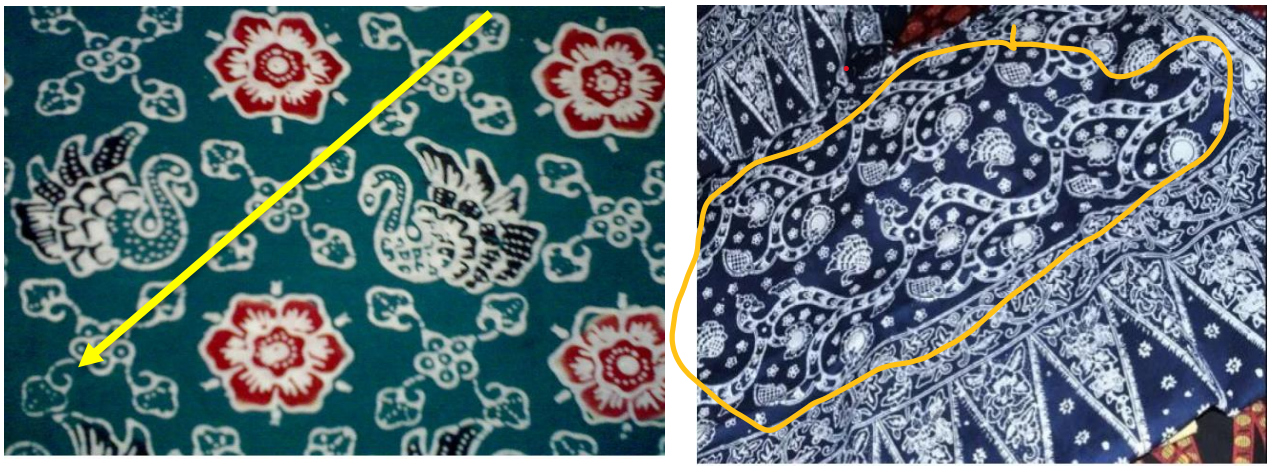


Figure 7. Translation on Batik motif

From figure 7 marked with a yellow line there is a pattern shift where this shift in mathematics is called translational where there is a displacement or shift from a point in a certain direction inside a straight line of flat plane. As a result, each plane in the straight line will also be shifted with a certain direction and distance. Translation is basically just changing the position, not the shape and size of the field. For the determination of the

shadow result after translation, it is to sum the abscissa x and the ordinate y with the translational distance.

$$A(x,y) \xrightarrow{T\binom{a}{b}} A'(x',y') = (x+a, y+b)$$

3. Rotation Concept

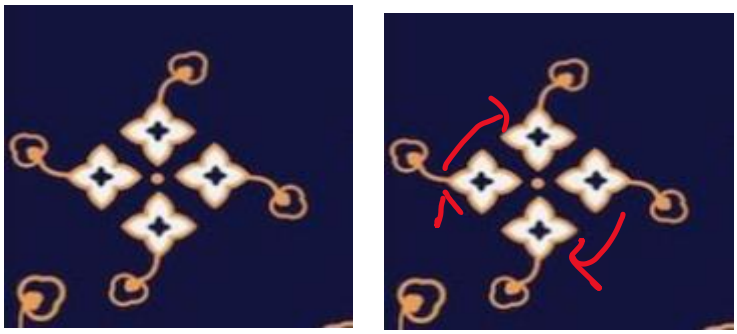


Figure 8. Rotation on Batik motif

In figure 7, which is a cut of the broken durian motif, there is a durian flower where in this picture there is a concept of rotation (rotation) if it is rotated following the direction of the red arrow, the object will rotate. The principle of rotation is to rotate an object against an angle and a center point that has a distance equal to the rotating point. In rotation there is no change in shape or size because the object only rotates.

Rotation has a rotation center, rotational direction and rotation magnitude, rotation with a center $O(0,0)$ of α can be expressed in the following equation :

$$A' = \begin{pmatrix} x' \\ y' \end{pmatrix} = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix} \begin{pmatrix} a \\ b \end{pmatrix}$$

While rotation with $P(m,n)$ and rotation magnitude α

$$A' = \begin{pmatrix} a' \\ b' \end{pmatrix} = \begin{pmatrix} \cos\alpha & -\sin\alpha \\ \sin\alpha & \cos\alpha \end{pmatrix} \begin{pmatrix} a-m \\ b-n \end{pmatrix} + \begin{pmatrix} m \\ n \end{pmatrix}$$

Application of Jambi Batik in Mathematics Learning

In the explanation above, it can be concluded that batik can be used in learning carried out by teachers, used as a learning medium and a mathematical realistic approach to transformation geometry material. Jambi batik motifs such as broken durian can be used on the concept of rotation and reflection. Students can be asked to observe the batik motifs they

use to find the concept of transformation geometry, how the movement of constructs differs in transformation geometry, students can know the coordinate axes, parallel lines and students can abstract real objects into mathematical models. (Ditasona, 2018) based on batik motifs, students easily understand mathematics, understand the relationship between mathematics and culture, so that students' and society's perceptions of mathematics become more appropriate, and mathematics learning can be more adapted to the cultural context of students and society, and mathematics can be more easily understood because it is no longer considered foreign by students and society. (Yanti & Haji, 2019) the concept of transformation geometry can be found in bengkulu basurek fabric.

CONCLUSION

Based on the discussion above, it can be concluded that in the Jambi batik mofif there is a transformation geometry including the concept of reflection, the concept of translation and the concept of rotation. The development of teaching materials that contain Jambi batik artwork can strengthen mathematics learning with cultural philosophy so that the cultivation of characters contained in batik motifs can make practice in mathematics. Realistic mathematics that is formed in the learning process is in the form of culture in society containing mathematical concepts so that the optimization of mathematical links in student life becomes wider.

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