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Research Article

Ethnomathematics of Kalimantan Batik in field Geometry learning in elementary school

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ABSTRACT

This article examines the use of ethnomathematics in Kalimantan batik in learning geometry in elementary schools. The purpose of this paper is to explore mathematical concepts contained in the Kalimantan batik motifs that can be utilized in the process of learning geometry in elementary schools. This research uses exploratory research and an ethnographic approach. The research data were obtained from literature studies, observations, interviews, and documentation. Based on the results of the study this study obtained 6 types of Kalimantan batik motifs, namely Tidayu batik motif (West Kalimantan), spot yarn motif (Central Kalimantan), Empiek Batik motif (East Kalimantan), clouded motif batik motif (West Kalimantan), Sasirangan batik motif Hiris Pudak (South Kalimantan), Pating Muang batik motif (Central Kalimantan). Geometry concepts for elementary school children in Kalimantan batik motifs are rectangles, circles, triangles, points, lines, minimum and maximum curves, reflection, translation, and fraction numbers. The alternative steps of learning are as follows: (1). Students and teachers carry out learning with the question and answer methods related to Kalimantan batik motifs; (2). Students are asked to observe the Kalimantan batik motif; (3). Students are asked to analyze the shapes contained in the Kalimantan batik motif; (4) Students are asked to present their work.

Keywords: ethnomathematics; field geometry; Kalimantan batik motif

1. INTRODUCTION

Elementary school age is the end of childhood which takes place at the age of 6-12 years. Following the characteristics of elementary school-age children who like to play, have great curiosity, are easily influenced by the environment, and like to form peer groups. Therefore, learning in elementary schools is strived to create a conducive and pleasant atmosphere. Imran explains that education is enculturation that occurs everywhere, in a person's place of life and at any time. Education is the process of entering a person into a culture, making a person behave according to the culture that enters him (Putra & Indriani, 2017). Culture is the result of thoughts, feelings, desires, and the work of humans or groups to improve human life. Thus, culture can be in the form of concrete objects and can also be abstract. The concrete objects in question are batik motifs, art objects, and artistic behavior. While an example of the abstract nature of culture is the scientific way of thinking and the ability to make things.

Culture in mathematics is often referred to as ethnomathematics. Ethnomathematics is a science used to understand how mathematics is adapted from a culture (Marsigit et al., 2018). Another opinion also explains that ethnomathematics is a form of mathematics that is influenced or based on culture (Utami et al., 2018). The culture in question is a culture that refers to a collection of norms that apply in society, beliefs, and values that are recognized by community groups. Education makes a person cultured. Education and culture are two elements that are interrelated and mutually support each other. The more people who will receive an education, the more cultured that person will be, and the higher the culture, the higher the education. Thus the effort to develop culture means one of the developments of education.

Indonesia is known for its local cultural diversity. From Sabang to Merauke, the culture of each region is different. This can be the main capital of the Indonesian people to make local education based on culture. But in reality, Indonesian culture continues to be lost in the flow of globalization without a cultural preservation strategy. Though the role of education to preserve local culture is very important. In addition to preserving, education can also be at the forefront of the success of a nation. Mathematics has been a part of human culture for a long time. Integration between mathematics and culture in a contextual and realistic form. Mathematics is part of a culture that can be applied and used to analyze innovative things. So, mathematics can be used as a tool to develop a culture of excellence. In addition, efforts to solve problems that arise, whether humans realize it or not have used mathematics. Learning mathematics in elementary schools is one of the subjects that is always interesting to learn because of the differences in characteristics, especially

between the nature of children and the nature of mathematics (Muger Apriansyah et al., 2018). For that, we need a bridge that can neutralize differences or contradictions. Elementary school-age children experience development in their level of thinking. This is because their thinking stage is still not formal, but elementary school students in the lower grades are not impossible and some of them think they are still in the pre-concrete stage.

Another benefit is that mathematics can shape the mindset of someone who studies it into a systematic, critical, logical-mathematical mindset with high accuracy. Mathematics for elementary school students is useful for the benefit of living in their environment, developing a mindset, and studying further sciences. The current mathematics learning process tends to be too theoretical, less contextual, and quasi-contextual. Learning is also less varied, thus affecting students' interest in further learning mathematics and students often perceive mathematics as a difficult subject to understand and learn. Teaching mathematics in schools is too formal so the mathematics that children find in everyday life is very different from what is found in school. Therefore, learning needs to provide content or a bridge between mathematics in daily life based on local culture and elementary school mathematics.

The meaning of bridging is to make a bridge between culture and mathematics. This step is important to recognize the different ways of thinking that can lead to different forms of mathematics, this is a field called mathematics. This can be interpreted that various mathematical concepts can be explored and found in a culture so that it can make it clear that mathematics and culture are interrelated, mathematics can be born from culture, mathematics can be extracted from a culture so that it can be used as a concrete learning resource that exists around students. Based on the explanation above, this article aims to explore mathematical concepts contained in Kalimantan batik motifs that can be used in the learning process of field geometry in elementary schools.

2. RESEARCH METHOD

In this study, the researcher used an exploratory type of research that aims to explore the form of Kalimantan batik motifs that can be used in the field geometry learning process in elementary schools and the approach used in this study is an ethnographic approach, namely an empirical and theoretical approach that aims to describe and analyze culture. based on intensive field research (Spradley, 2006). The research instrument is the researcher himself and is supported by other instruments including field notes, observation guidelines, and documentation. The purpose of the researcher itself is the researcher who acts as a data collector and cannot be replaced, so the role of the researcher is the main instrument. After the data is collected and then reduced to obtain valid data through triangulation of sources, methods, or time, the next step is domain analysis to obtain an overview of the Kalimantan batik motifs and determine categories and group data by category. Furthermore, taxonomic analysis is carried out by describing each domain in detail based on the geometrical concept of the plane contained in the Kalimantan batik motif.

3. RESULTS AND DISCUSSION

3.1 Ethnomathematics

Ethnomathematics was first coined by Ubiratan D'Ambrioso, a mathematician and mathematics teacher in Brazil in 1977. The term ethnomathematics was first used by D'Ambrioso as a methodology for tracking and analyzing the processes of production, transfer, dissemination, and institutionalization of mathematics in various cultural systems. where D'Ambrioso distinguishes mathematics into academic mathematics that is taught in schools, and ethnomathematics which is described as mathematics that is practiced among identifiable cultural groups.

Ethnomathematically comes from the prefix "ethno" which means something very broad and refers to the socio-cultural context, including language, codes, myths, behaviors, and symbols, while "mathema" is a basic word that means to explain, know, understand and carry out activities and tics. is a suffix word that comes from the word techne which has the same meaning as technique (Akmalia et al., 2020; Arwanto & Pd, 2017; Ulum et al., 2018). In addition, Ethnomatematics is an application of a contextual approach which is also usually combined with a scientific approach. Developing ethical and moral values is one of the targets to be achieved in the current educational process. Success in building student character automatically helps in building national character. The progress of a nation depends on the character of its people, their intelligence capabilities, the superior thinking of its citizens, the synergy of its leaders, and so on. By implementing the ethnomathematics approach, it is hoped that teachers and students will get ideas about ethnomathematics and ultimately be able to improve mathematics learning achievement.

Ethnomathematics is a science used to understand how mathematics is adapted from a culture (Anista & Marsigit, 2020). Another opinion also explains that ethnomathematics is a form of mathematics that is influenced or based on culture (Utami et al., 2018). The culture in question is a culture that refers to a collection of norms that apply in society, beliefs, and values that are recognized by community groups. Based on the description above, the writer can conclude that ethnomathematics is another name for mathematics that is practiced by a small or large group in the socio, cultural and cultural scope.

3.2 The Role of Ethnomathematics in Learning Mathematics

Learning mathematics requires an approach so that the teaching and learning process in the classroom is more effective and efficient. In line with the learning objectives themselves, learning is carried out so that students can accept and be able to master the material being taught and apply it in solving problems. To achieve learning teacher must be able to understand what factors exist in the student's environment towards learning. One of the factors that influence learning is culture. (Jannah, 2019; Monica et al., 2021; Zayyadi, 2017). Culture is the results of thoughts, feelings, desires, and the work of humans or groups to improve human life. The culture here really determines how students view things. As well as in understanding mathematical material. If material is very difficult from the cultural schema that is owned, of course, the material is difficult to understand. Therefore we need an approach to learning mathematics that can connect mathematics with the culture that surrounds us (Astriandini & Kristanto, 2021; Febriyanti et al., 2018). Ethnomathematics is a bridge between mathematics and culture, as explained above, ethnomathematics believes that there are different ways of doing mathematics in student activities in society. (Nuh & Dardiri, 2016) By applying ethnomathematics as a learning approach, it will be possible for the material studied to be related to their culture so that students' understanding of material becomes easier because the material is directly related to their culture which is their daily activity in society.

3.3 Concept of Field Geometry in Elementary Schools

In this article, 6 Kalimantan batik motifs can be explored to find mathematical concepts in field geometry in elementary school. Are as follows:

a. Tidayu batik motif (West Kalimantan)

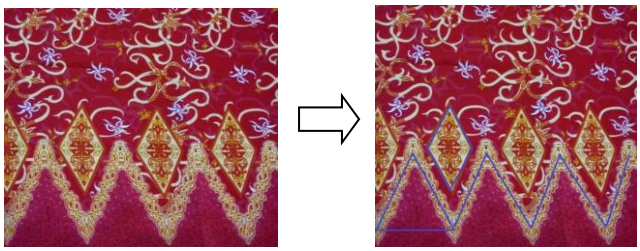


Figure 1. Tidayu Batik Motif

Tidayu is an abbreviation of Chinese, Dayak, and Malay. The three are the three major ethnic groups in Singkawang City who live side by side with other tribes. Tidayu batik has been popularized ten years ago. The idea and idea of batik itself originated from a design competition initiated by Elisabeth Majuyetty, wife of Hasan Karman, former Mayor of Singkawang for the period 2007-2012. The Tidayu motif design itself consists of developing various motifs that represent each culture in Singkawang City. Currently, there are six patterns of Tidayu Batik, each of which has its characteristics, namely Lembayung, Beuntai, Lantern, Jungle, Harmoni, and Stork. Each pattern consists of three elements that represent each existing ethnicity and is printed in a variety of color choices. In the Harmoni motif, the oriental detail of the square box between the sides is decorated with the Malay Rebung Pucuk Motif in the middle and tied with the Dayak motif. As the name implies, this motif symbolizes the harmony of tribes and cultures in Singkawang City. Therefore, the mathematical concepts that exist in the Parang Teja batik motif are Square; Parallelogram; Minimum and maximum curves, and triangles.

Figure 1 shows the batik motif in the form of a geometric plane in the form of a parallelogram. A figure is shown with 2 pairs of parallel sides that are equal in length and two opposite angles that are equal in measure. These two properties are enough to illustrate that the motif on Tidayu batik is a plane geometric pattern in the form of a parallelogram. Other patterns in the form of plane geometry can be seen by drawing guide lines on the minimum and maximum curve patterns so that a triangular shape is formed. If analyzed, it is possible that the triangle formed is an isosceles triangle. However, this needs to be proven further by paying attention to the properties of an isosceles triangle.

b. Yarn Spotted Batik Motif (Central Kalimantan)

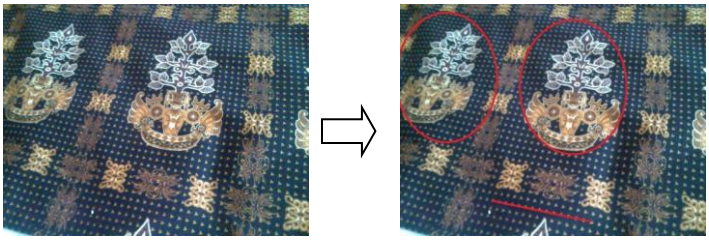


Figure 2. Yarn Spotted Batik Motif

Yarn Spots have a variety of patterns. There is a philosophy in the cloth that has been a guide for the Central Kalimantan Dayaks. One of the symbols of Dayak belief is Batang Garing or the tree of life. This tree symbolizes a vertical relationship between humans and the ruler they believe in. And the horizontal relationship between humans and other creatures on earth (Alexandro et al., 2020; Pratiwi & Yuningsih, 2022). This tree later became one of the characteristics of the famous Central Kalimantan batik motifs. Apart from the kawit tuyan motif, jars, spears, shields, and balain nihing. The mathematical elements in the spotted thread batik motif are 1) Dots; 2) Lines and 3) Mirroring. If we pay attention again, in **Figure 2** we can find points, and if we draw auxiliary lines at these points, a line is obtained. A point is the smallest part of a geometric object because it has no specific size, either length, width or thickness. While the line is the basic concept of geometry that extends indefinitely in both directions without any curvature. So that Points and Lines are the basic elements of a geometry. A geometric shape will not be formed without starting with a point that is arranged into a line and then becomes a geometric shape. So with this Batik Thread Spot motif, the concept of dots and lines can be conveyed.

c. Ampiek Batik Motif (East Kalimantan)

Figure 3. Ampiek Batik Motif

Ampiek is a Kutai language that means carving cloth. By Emi Alaydrus, Ampiek was later used as the name of his batik motif, as well as the name of his business. Ampiek Balikpapan's inspiration is the city's geography, namely: forest, hills, and sea. From the three, emerge the root pattern of mangroves, Karamunting, and dugong dugongs. The mathematical elements in the Empiek motif are the shape of a semi-circle, hexagon, circle, and the concept of fractional numbers. If observed in **Figure 3**, by using the guide lines obtained circle and semicircle geometric shapes. Although the concept of a semicircle has not been explained in depth to elementary school students, it can be introduced by showing a comparison of a complete circle with a semicircle. Meanwhile, the concept of the circle itself can be explained as the basis for recognizing plane geometric shapes. Both can be found in Empiek Batik Motifs.

d. The Clouds Batik Motif (West Kalimantan)

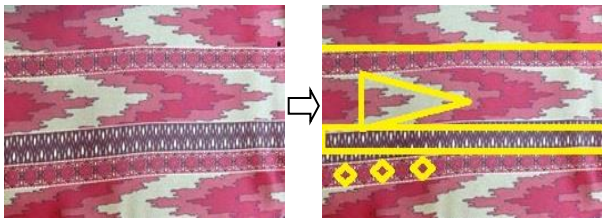


Figure 4. The Clouds Batik Motif

The cloud-patterned cloth was formerly worn by relatives of the Amantubillah Mempawah Palace. Cloud patterned cloth is usually always worn at big royal events. One of the relatives of the Kingdom of Amantubillah Mempawah who still keeps the cloth with the pattern of the past is Encik Maryam. The age of this noble-blooded woman has now reached more than 100 years. The cloth is in the form of a sarong, with a floating cloud motif. Because of the nature of the clouds that are above the sky and are in procession, then by the Amantubilah Mempwah Kingdom, this cloth is specially designated by the relatives of the royal dignitaries. Encik Maryam herself received a woven cloth patterned with clouds when she was proposed to by her husband, Daeng Abdullah. Along with the times, the cloth with the Berarak Cloud pattern has now been used by the people of Pontianak district in particular, and West Kalimantan in general. To make the cloth with the Cloud Berarak more popular, all civil servants in the Pontianak Regency Government have now chosen to clothing made from the cloud cloth as one of the work clothes. The mathematical elements contained in the cloud motif are triangles, straight lines, quadrilaterals, rectangles, and translations. The geometric elements that can be used as elementary school learning materials from the Berarak Clouds Batik motif are Straight Lines, Quadrilaterals, and Triangles. The concepts of quadrilaterals and triangles are introduced to elementary school students to the concept of calculating the day after tomorrow and circumference. In learning, students can make observations on the Awan Berarak batik cloth motifs by providing auxiliary lines so that a flat area is obtained. Students observing Together can then calculate the area and perimeter of the flat shapes found.

e. Hiris Pudak Sasirangan Batik Motif (South Kalimantan)

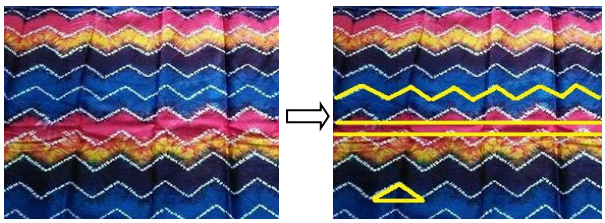


Figure 5. Hiris Pudak Sasirangan Batik Motif

Banjarmasin is famous for its Sasirangan woven fabric craft with the craft center located in Sasirangan Village. Sasirangan is a batik cloth typical of the Banjar tribe in South Kalimantan. The uniqueness of this Sasirangan batik cloth can be seen in the variety of various batik motifs. Pudak is a plant called the Banjar people for pandanus plants. This pandanus plant is often planted in the yard of the Banjar tribe. Pandan is often used as a natural fragrance or flavoring agent in every dish. Besides being used for giving a delicious aroma, the pandan plant is widely used by the Banjarese as cake coloring, and as a mixture of potpourri (flowers in traditional ceremonies) when carrying out traditional Banjarese events such as weddings or other events. The Sasirangan Hiris Pudak motif means that as humans, we must be useful to others. The mathematical elements contained in the sasirangan Hiris shoulder batik motif are minimum and maximum curves, triangles, and parallel lines. The triangle concept can also be studied by analyzing the Sasirangan hiris Shoulder batik motif. As is the case with other batik motifs, using the auxiliary lines, a triangular image will be obtained on the batik cloth motif. In other words, students will easily learn the geometry of planes/flat planes by observing the batik cloth motifs around them.

f. Pating Muang Batik Motif (Central Kalimantan)

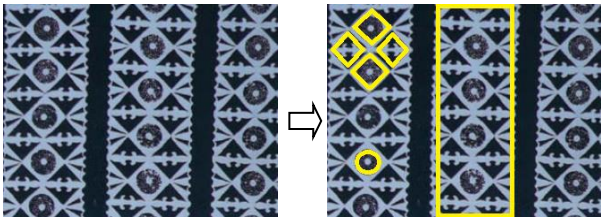


Figure 6. Pating Muang Batik Motif

Rempang Garantung batik motif has a dark base color with white or gray motifs. This batik is symmetrical with the same length and shape. The mathematical elements contained in the Pating Muang motif are rectangles, rectangles, circles, and quadrilaterals.

3.4 The Use of Ethnomathematics in Kalimantan Batik in Learning Field Geometry in Elementary Schools

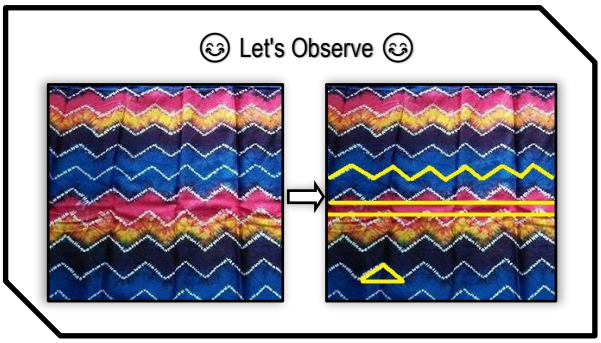
Based on the concept of plane geometry for elementary school children in the Kalimantan batik motif described above, batik motifs are an alternative for elementary school geometry learning, such as recognizing points, angles, lines, quadrilaterals, and other simple shapes. The alternative steps for learning field geometry for elementary school children using the batik motif are as follows:

Students and teachers carry out learning with a question and answer method related to Kalimantan batik motifs.

Do you know!

1. Batik is a state asset?
2. How many types of batik are there in Kalimantan?
3. Do you have batik clothes? What motifs have you used?

Students are asked to look for existing or owned batik cloth motifs, especially Kalimantan batik motifs. After that, students are asked to observe the batik motifs and look for geometric shapes that are related to the material points, angles, lines, rectangles, and other shapes. As an example:



After students find geometric shapes related to the material, students are asked to analyze the shapes found in Kalimantan batik motifs. The analysis carried out can analyze the shape of the shape, its properties, or to a more in-depth analysis. For an example.

4. CONCLUSION

Based on the results of the study in this study, 6 types of Kalimantan batik motifs were obtained, namely tidayu batik (West Kalimantan), speckled thread batik (Central Kalimantan), empiek batik (East Kalimantan), cloud patterned batik (West Kalimantan), sasirangan batik. hiris pudak (South Kalimantan), pating muang batik motif (Central Kalimantan). The concept of plane geometry for elementary school children in Kalimantan batik motifs is quadrilaterals, circles, triangles, dots and lines. The alternative learning steps are as follows: (1) Students and teachers carry out learning using discussion methods related to Kalimantan batik motifs; (2) Students are invited to look for various Kalimantan batik motifs; (3) Students are asked to analyze the shapes found in the Kalimantan batik motifs; (4) Students are asked to present their work. The suggestion in this study is that researchers only discuss one sub-topic of study, therefore, to be more effective and efficient in their discussion, researchers give freedom to other researchers to develop other mathematical materials related to the cultural conditions in which students live.

AUTHOR'S CONTRIBUTIONS

The authors discussed the results and contributed to from the start to final manuscript.

CONFLICT OF INTEREST

There are no conflicts of interest declared by the authors.

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