

GIRILOYO WRITTEN BATIK MOTIFS VIEWED FROM AN ETHNOMATHEMATICS PERSPECTIVE

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Abstrak

Matematika sekolah yang sering dipelajari pada umumnya bersifat formal, kaku, dan ketat. Siswa masih mengalami kesulitan dalam mengaplikasikan konsep matematika dalam kehidupan sehari-hari. Hasil PISA Indonesia 2023 menunjukkan kemampuan literasi matematis siswa Indonesia saat ini masih tergolong rendah. Kurikulum merdeka memberikan kelonggaran bagi guru untuk mengembangkan kemampuan literasi matematis dengan model pembelajaran matematika inovatif berbasis konteks kehidupan nyata salah satunya dengan budaya. Etnomatematika sebagai kajian penelitian yang mengkaitkan budaya dan matematika. Tujuan dari penelitian ini untuk mengetahui hasil dari kajian etnomatematika pada motif batik tulis giriloyo khususnya pada motif sidomukti, sidoluhur, dan sidoasih. Jenis penelitian ini yaitu penelitian kualitatif dengan pendekatan etnografi. Metode yang digunakan untuk pengumpulan data yaitu dengan wawancara, observasi, dan dokumentasi. Hasil penelitian ini diperoleh bahwa motif batik tulis giriloyo mengandung konsep transformasi geometri berupa refleksi.

Kata Kunci: etnomatematika, batik tulis, transformasi geometri

Abstract

School mathematics which is often studied is generally formal, rigid and strict. Students still experience difficulties in applying mathematical concepts in everyday life. The results of PISA of Indonesia 2023 show that the mathematical literacy skills of Indonesian students are currently still relatively low. The independent curriculum provides flexibility for teachers to develop mathematical literacy skills with innovative mathematics learning models based on real life contexts, one of which is culture. Ethnomathematics as a research study that links culture and mathematics. The aim of this research is to find out the results of an ethnomathematics study on giriloyo batik motifs, especially on sidomukti, sidoluhur and sidoasih motifs. This type of research is qualitative research with an ethnographic approach. The methods used for data collection are interviews, observation and documentation. The results of this research showed that the giriloyo batik motif contains the concept of geometric transformation in the form of reflection.

Keywords: Ethnomathematics, Written Batik, Geometric Transformation

Introduction

School mathematics which is often studied is generally formal, rigid and strict. Students still experience difficulties in applying mathematical concepts in everyday life, and vice versa, students also experience difficulties in solving everyday problems with mathematical concepts learned at school (Haji, 2018).. The role of education is very important in placing mathematics as one of the foundations of science to solve everyday problems (Zubaidah, 2019). A person's cognitive structure greatly influences an individual's mathematical knowledge. Individual mathematical

knowledge is an individual's tendency to face everyday problems. The role of mathematics in the context of daily life functionally carried out by individuals is called mathematical literacy.

Indonesia's PISA results from year to year show that the mathematical literacy abilities of Indonesian students are currently still relatively low (Mubarrok et al., 2023). Therefore, the government, through the Ministry of Education and Culture, continues to strive to improve students' mathematical literacy skills through literacy and numeracy programs which are reflected in the independent curriculum. The

independent curriculum applies a Minimum Competency Assessment (AKM) to determine students' literacy and numeracy abilities. Mathematical literacy is important for students because with mathematical literacy, students not only understand mathematical concepts but are also able to use mathematical concepts in solving everyday problems (Wawat, 2022). Mathematical literacy also helps students solve everyday problems efficiently by formulating and interpreting mathematics in various problem contexts (Hapsari, 2019). The independent curriculum provides flexibility for teachers to develop mathematical literacy skills with innovative mathematics learning models based on real life contexts, one of which is an approach to the culture where students live.

One of Indonesia's cultural heritages that deserves to be preserved is batik. Batik continues to develop from time to time, both in terms of motifs, manufacturing techniques, and so on (Smend & Harper, 2015). Batik is passed down from generation to generation, this is the cultural value of batik itself. There are many batik motifs in Indonesia, almost every region has its own distinctive batik pattern (Iskandar & Kustiyah, 2017). In fact, each region has its own unique batik motifs and colors that differentiate one region's batik from another. Apart from having high artistic value, batik motifs also contain their own philosophical meaning based on the beliefs of the people where the batik was made or the goals of the creator of the motif (Haryono, 2019). Batik based on its motif is divided into geometric batik motifs and non-geometric batik motifs. Geometric batik motifs are batik whose patterns form geometric arrangements such as lines, arches, squares, rectangles, rhombuses, kites, triangles, parallelograms, circles, etc. Meanwhile, non-geometric motif batik contains ornaments of flora, fauna, temples, mountains, etc. (Supriono, 2016). So if you look at the motifs, batik is very closely related to mathematics, especially geometric batik motifs because they have a flat structure.

Meanwhile, if you look at the technique of making batik, it is divided into written batik, stamped batik, jumputan, printing and

night screen printing. One community that still maintains the existence of batik using written techniques is the batik community in Giriloyo, Wukirsari, Imogiri, Bantul, Special Region of Yogyakarta. Giriloyo Written Batik is closely related to the existence of the Yogyakarta Palace, this is because many of the male residents of Giriloyo hamlet were servants of the Yogyakarta Palace, as guardians of the tombs of the Mataram kings of Yogyakarta and Solo which are located in Imogiri, Bantul, precisely south of Wukirsari village.

Meanwhile, women were trained by relatives from the Yogyakarta palace to become hand-written batik craftsmen. This activity has been going on for generations until now, where the hand-written batik products from Giriloyo hamlet are then sold to batik traders in the city of Yogyakarta. Currently, the Giriloyo written batik community is dominated by mothers over the productive age, so efforts are needed to preserve its existence by introducing this written batik to the younger generation from an early age, starting from school. The classroom is the best place to teach culture, as the function of education is to maintain the existence of culture itself. One of them is by exploring the mathematical concepts contained in written batik using an ethnomathematics approach.

Ethnomathematics as a research avenue in mathematics education has encouraged many researchers to explore mathematical concepts contained in culture, starting from cultural systems, traditional ceremonies, cultural products, and so on (Fitriatien, 2017). Ethnomathematics is able to raise the cultural wisdom of society as a means of increasing students' motivation in learning mathematics (Abdullah, 2020). The results of ethnomathematics exploration of batik have been carried out on many batik models such as patterns on Surakarta batik motifs (Astriandini & Kristanto, 2021), batik Kawung (Syahdan, 2021), batik Gedog (Wati, et. al, 2021), and many more. much more. This ethnomathematics exploration has revealed various mathematical concepts contained in batik motifs, but has not linked the relationship between philosophical meanings and mathematical concepts.

Therefore, this research will examine the giriloyo batik motif, especially the sidomukti, sidoluhur and sidoasih motifs from a philosophical and ethnomathematics perspective.

METHODS

This research is qualitative research with an ethnographic approach. The type of data used in this research is qualitative. The subject of this research is a community of written batik craftsmen in Giriloyo hamlet, Wukirsari, Imogiri, Bantul, DIY which consists of 5 written batik craftsmen. The data collection techniques used in this research are interview, observation, and documentation. Interviews were conducted with batik craftsmen to dig up information related to the history of giriloyo batik, the process of making hand-written batik, types of batik motifs, and the philosophical meaning of batik motifs. Observation of the batik making process, batik motifs in the gallery. Documentation of the batik making process and batik motifs.

In this research, the researcher becomes the instrument or research tool. The technique for checking the validity of the data is carried out using triangulation techniques which include source triangulation, data collection technique triangulation, and time. The data analysis techniques in this research include data reduction, presentation of data, and drawing conclusions. At data reduction stage, the author sorts batik motifs that contain ethnomathematics concepts. At presentation of data, the motifs that have been selected are then analyzed in the mathematical domain, followed by taxonomic analysis to look for more specific mathematical concepts, for example geometry.

RESULTS AND DISCUSSION

Giriloyo Village is the largest village of hand-written batik craftsmen in Bantul district, DIY. The Giriloyo batik craftsman community has been going on for

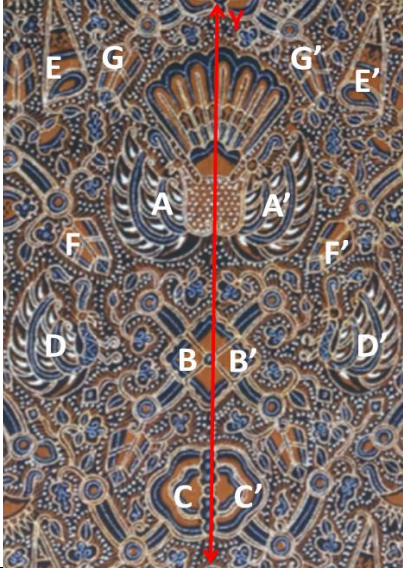
generations, from generation to generation. The number of Giriloyo batik craftsmen consists of around 600 people who are members of several groups. To produce one batik cloth, it takes approximately 2 months (Wahidin, 2019). The work on a written batik cloth is carried out alternately according to the stages of the written batik making process. The stages in the process of making Giriloyo Bantul Yogyakarta batik consist of; 1) preparing the cloth that will be used for batik in this case is mori cloth; 2) mordanting or soaking the fabric overnight followed by boiling the fabric in boiling water before applying the pattern; 3) make a pattern on paper (Nyungging), followed by transferring the pattern to the cloth (Njiplak); 4) the batik process involves applying wax to the pattern; 5) dyeing, the process of giving color to fabric; 6) fixation, covering the part that has been colored with wax, to be colored again; 7) remove wax from the cloth by dipping the cloth in boiling water.

The stage of making written batik that is closest to mathematical concepts is the pattern making stage (Nyungging). Pattern is the smallest unit of batik motif. The written batik motifs made by Giriloyo batik craftsmen consist of traditional/classic motifs and contemporary motifs. In this research, several batik motifs with geometric motifs will be discussed with the aim that this batik concept can be used as mathematics learning material in the classroom.

Sidomukti motif

The word Sidomukti comes from the Javanese language "sido" which means to be and "mukti" which means happiness. So sidomukti means being happy (Rosati Anggraita Aflaha, 2022). This sidomukti motif batik cloth is usually worn by married couples as a prayer for both partners to achieve happiness (Syarofinisa, 2015). The ethnomathematics concept in the sidomukti motif can be seen in the table below;

Table 1. Ethnomathematics Concepts in Sidomukti Motifs

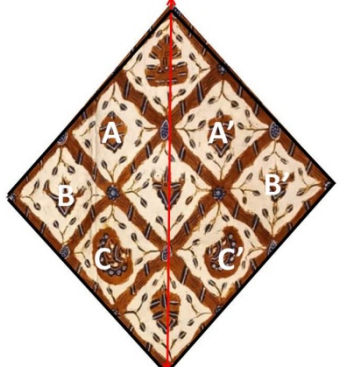
Sidomukti Batik Motif	Ethnomathematics Concept
	<p>In the Sidomukti motif there is a geometric concept in the geometric transformation chapter, namely the concept of reflection on the Y axis. The details are as follows;</p> $A \xrightarrow{M_Y} A'$ $B \xrightarrow{M_Y} B'$ $C \xrightarrow{M_Y} C'$ $D \xrightarrow{M_Y} D'$ $E \xrightarrow{M_Y} E'$ $F \xrightarrow{M_Y} F'$ $G \xrightarrow{M_Y} G'$

Sidoluhur motif

The word Sidoluhur comes from the Javanese language "sido" which means to be and "sublime" which means high (Kusumawati & Hartowiyono, 2017). So sidoasih means human hope to achieve a high position and become a role model. This Sidoluhur batik motif is a category of geometric motifs with a rhombus pattern. A rhombus is a flat shape that has four sides of equal length, diagonals intersect and are perpendicular to each other, opposite angles are equal, and adjacent angles are perpendicular to each other. This sidoluhur batik motif with a rhombus pattern stands on the philosophical concept of Qibla Papat Lima Pancer and Sadulur Papat Lima Pancer. The community's view that Qibla

Papat Lima Pancer is closely related to the sacred number $5 = 4+1$, which means four corners of the cardinal directions with one center. Meanwhile, Sadulur Papat is five pancer, which means four brothers who accompany the birth of the baby (pancer), namely amniotic fluid, ari-water, blood and umbilical cord. So if you combine the two, they form the concept of the numbers panca (five) and nawa (nine) in a Javanese perspective (Setyo Budi, Tiwi Bina Affanti, 2023). The standard size of rhombuses in batik motifs is 10 x 10 cm, which is contained in a piece of jarit cloth measuring 230 cm x 90 cm, so the number of motifs is around 107 motifs. Other ethnomathematics concepts can be seen in the table below;

Table 2. Ethnomathematics Concepts in Sidoluhur Motifs

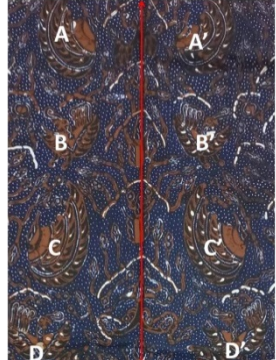
Sidoluhur Batik Motif	Ethnomathematics Concept
	<p>In the sidoluhur motif there is a geometric concept in the flat shape chapter, namely rhombuses and the geometric transformation chapter, namely the concept of reflection on the Y axis. The details are as follows;</p> $A \xrightarrow{M_Y} A'$ $B \xrightarrow{M_Y} B'$ $C \xrightarrow{M_Y} C'$

Sidoasih motif

The word Sidoasih comes from the Javanese language "sido" which means to be and "asih" which means love. So sidoasih means human hope for a life full of

love(Dedy, Sartono, & Retnowati., 2019). Therefore, this Sidoasih motif batik is often worn at weddings. The main elements in this sidoasih motif include growing plants.

Table 3. Ethnomathematics Concepts in Sidoasih Motifs

Sidoasih Batik Motif	Ethnomathematics Concept
	<p>In the Sidoasih motif there is a geometric concept in the geometric transformation chapter, namely the concept of reflection on the Y axis. The details are as follows;</p> $A \xrightarrow{M_Y} A'$ $B \xrightarrow{M_Y} B'$ $C \xrightarrow{M_Y} C'$ $D \xrightarrow{M_Y} D'$

The sidomukti, sidoluhur and sidoasih motifs above are some examples of written batik motifs made by giriloyo batik craftsmen. There are many more batik motifs that can be studied in detail, for

example the parang motif, which is a motif with a 45 degree slope and the tambal motif which is an arrangement of triangular shapes. As an example in the following image.



(a)



(b)

Figure 1. (a) parang motif (b) tambal motif

The batik motifs above are only a small part of the batik motifs in Yogyakarta. There are many more batik motifs that can be connected to mathematical concepts, especially geometric batik motifs such as sidoluhur motifs, kawung motifs, tambal motifs and so on. These motifs can be used in classroom learning with a contextual approach (Richardo, 2020) or a STEAM (Science, Technology, Engineering, Arts and Mathematics) (Darmadi, Budiono, & M. Rifai, 2022) approach. Of course, this will increase students' love for Indonesian culture

(Abdullah, & Rahmawi, 2021), especially their love for batik as a cultural heritage that needs to be preserved.

CONCLUSION

Based on the results and discussion, it can be concluded that the giriloyo batik motif contains mathematical concepts, especially batik motifs with geometric patterns such as the sidoluhur motif, but it cannot be denied that non-geometric batik motifs such as the sidomukti and sidoasih

motifs. The ethnomathematics concept is the concept of geometric transformation.

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