Two Dimensional Object in square and rectangles: Batik artwork approach

Mika Ambarawati and Ririn Dwi Agustin
IKIP Budi Utomo, Malang, Indonesia
*mikaambarawatio88@gmail.com

Abstract. This study aims to describe the ethnomatematics study: square and rectangular on the motif of Malang batik artwork. This research is a qualitative-explorative research that is exploring batik motifs in square and rectangular shapes. The data in this study are in the form of library study data from both documents and electronic media. In addition, in the form of interview records related to Malang batik artwork and observations. The results of the study from this study indicate that: 1) on the kawung motif and Malang written batik there is a square concept; and 2) in Malang's masked batik motif there is a rectangular concept. The concept of square and rectangle in Malang batik artwork can be applied in mathematics learning. Especially in two-dimensional figure material.

1. Introduction
Indonesia is a country consisting of land and sea. There are several large and small islands separated by the sea which lead Indonesia to be called as Nusantara (Utomo, Joebagio, & Djono, 2018). Indonesia's cultural diversity from Sabang to Merauke is a priceless asset, so it must be maintained and preserved. The existing cultural diversity in our country is one of forms and a evidence where our country is rich of cultures (Miftah, 2016). In addition, the Indonesian nation has a diversity of cultures and traditions, languages, religions, beliefs, geographical conditions, and levels of civilization.

Education that is charged with multicultural values is a staged-educational process that can be used as a binder and a bridge to accommodate differences, such as ethnicity, language, culture, gender, region, and religion in a multi-cultural society in order to create intelligent, wise, and polite personality in dealing with diversity issues (Slamet, Masrukh, Haryono, & Wasino, 2017). Cultural values that are the foundation of national character are important things to be instilled in each individual. Thus, cultural values need to be instilled early, so that each individual is able to better understand, interpret and appreciate the importance of cultural values in carrying out every activity of life. Cultivating cultural values can be done through the family environment, education, and within the community (Wahyuni, Tias, & Sani, 2013).

Mathematics is closely related to the development of human civilization. Mathematics as a scientific discipline can develop and grow alongside human development. Human nature helps humans to understand and overcome social, economic and natural and cultural problems. Mathematics has changed universally (Rizkianto, Zulkardi, & Darmawijaya, 2016). For example, the concept of ethnomatematics. As a new conceptual field and an emerging
research program, ethnomathematics evolved from a rhetoric networking the interplay among mathematics, cultural anthropology, education, and politics (Chahine & Kinuthia, 2013).

Ethnomathematics is a form of mathematics that is influenced or based on culture. One approach that can provide opportunities for students to improve mathematical communication skills is constructivism learning and learning by applying culture. Ethnomathematics encourages us to witness and attempt to understand how mathematics continues to be adapted and used by people around the world. Students should be encouraged to construct personal mathematical understandings and be able to explain their work (Linda H.L. Furuto, 2013).

In this conception, ethnomathematics is a program that investigates the ways in which different cultural groups comprehend, articulate, and apply ideas and concepts that can be identified as mathematical practices. Moreover, ethnomathematics as a program may be described as a way in which people from a particular culture use mathematical ideas and concepts for dealing with quantitative, relational, and spatial aspects of their lives (Rosa & Orey, 2013). Integration of ethnomathematics into the mathematics curriculum not only enables students to develop a wide variety of problem-solving strategies but also legitimises their ownership of such knowledge. This in turn adds more meaning to many abstract mathematical ideas (Matang, 2002).

The extended notion of ethnomathematics as dealing with pupils’ everyday mathematical practices has equality of all pupils as its main objective. Ethnomathematics becomes a philosophy of mathematics education where mathematical literacy is a basic right of all pupils. The teaching process tries to reach all pupils and tries to involve them in the learning process of mathematics, irrespective of their cultural diversity (François, 2012).

Batik is one of Indonesia's cultural heritages that deserves to be preserved. Batik is a product of culture and as we all know it is not only a cultural heritage but also provide a livelihood for millions of people of Indonesia. Batik industry scattered throughout Indonesia, not just in Java and Madura (Steelyana, 2012). Batik preservation is carried out with the development of batik which starts from the next process of processing using stamp so that the term batik and stamp batik appears. In addition to the batik process, developments also occur in batik motifs and patterns (Dewi, Dari, & Elita, 2016). Batik is a form of visual art on textile materials produced using traditional drawing techniques originating from Indonesia (Tresnadi & Sachari, 2015). The appearance of a variety of batik would be a pleasure for batik lovers often used as clothing, furniture, or other equipment in everyday life (Purnamasari, 2017).

Every batik motif has a history that is closely related to regions in Indonesia. For Example the motif objects are things that can be found in Banyuwangi area such butterfly, marine vegetation, coconut, etc. The motif pattern is in straight or diagonal alignment (Hadi, Qiram, & Rubiono, 2018). In addition, batik motifs are related to material in mathematics. Such motifs, for example, square motifs, rectangles, curves, geometry, etc.

Malang is a Javanese tribe consisting of various sub-districts that have a culture/tradition that develops in the community. Therefore, the ethno-mathematical study of square and rectangles on batik motifs will be an innovation in Indonesian education knowledge.

2. Methods

This research is a qualitative-explorative research that is exploring batik motifs in square and rectangular shapes. Qualitative researchers are apt to flexibly develop questions. By raising questions on the spot, a qualitative researcher can gain a deeper insight towards the respondent's beliefs, attitudes, or situation (Shakouri, 2014). he expedition in the form of the build can be utilized in learning. The approach used is an ethnographic approach, namely an empirical and theoretical approach. The object in this study is the type of motif of Malang batik artwork associated with square and rectangle.

The data in this study are in the form of library study data from both documents and electronic media. In addition, in the form of interview records related to Malang batik artwork and observations. This is similar to opinion (Imran & Yusoff, 2015) is qualitative data consisted of semi structured interviews and field observations. This research is qualitative research so that researchers act as the main instrument for collecting data and information needed by researchers. In addition to the main instrument, it is then combined with auxiliary instruments, namely field notes, interview guidelines, observation guidelines, and documentation.
3. Result And Discussion

Malang City is the second largest city in East Java after Surabaya. Besides that, Malang city also has a very strategic location in the middle of Malang regency. It is expected that urban facilities and infrastructure owned can support economic activities dynamically so as to be a simultaneous change of the city towards the service industry, including tourism and education.

Batik is a careful work of art that combines creative and innovative tastes and inovatif or creative mindsets along with the tastes development that can produce the integration of materials, hues, colors, values, meanings, symbolic and philosophical (Sujadno & Safitri, 2018). Malang's unique batik is also called Malang batik. Malang Batik originated from batik that has been used in traditional ceremonies since the nineteenth century. The batik is generally patterned Sidomukti Malang with white box decoration in the middle which is commonly called Modhang Koro. This motif is used as udheng (male) and sewek (female) in official events for all levels of society. Malangan Batik has three main characteristics and is part of the three main components of batik, namely the first in tanahan or the base taken from batik motifs in Candi Badut. The second component is the main motif (filled in) filled with images of Malang Tugu flanked by lion hair on the left and right sides as the symbol of Malang City, and the third component is an ornamental motif for tumpal (peripheral plus isenisen) filled with three tendrils that form a chain. Decorative motifs in the form of flower tendrils intended to describe Malang as a city of flowers (Hermawati, Isma, & Mas, 2018).

Typical Malang motifs have been developed to date with various creations from basic motives. The combination of colors, fields, lines, and other textures creates beauty in harmony. In addition, there are also motives which are a combination with mathematical concepts.

Malang Batik Artwork

Batik is a symbol reflecting Indonesian culture which has been acknowledged by UNESCO since 2009. Batik has various motifs or patterns (Minarno, Maulani, Kurniawardhani, Bimantoro, & Suciati, 2018). The Figures of several batik motifs found in Malang are as follows.

![Figure 1. Batik Motif Kawung](image1)

![Figure 2. Handmade Batik](image2)
Ethnomathematics in Malang Batik Artwork

In these batik artworks there are mathematical concepts related to square and rectangle. Square and rectangular shapes are found in batik, namely the lines or fields that two-dimensional figure shape. The square and rectangle are types of two-dimensional figure.

a. Square on the motif of Malang Batik Artwork

The kawung batik motif is known from the 13th century which was created by the Mataram Sultan at that time. Kawung itself is a motif of the fruit from the fruit of the palm tree trunk. On the kawung batik motif there is a square concept. The image below is an example of the kawung motif.
Handmade batik Malang has a distinctive basic motif. Written batik is a cloth decorated with batik textures and patterns using hands (Adhi, 2016). The basic motif is the temple clown, isen-isen in the form of an unfortunate monument. In addition, it has a boket or decorative fabric edges with Figures of flowers forming a chain pattern.

Based on the *kawung batik* motif and the batik motif handmade, the square concept is obtained. Square is a rectangular two-dimensional figure whose angles are right angles and all the sides are equal in length. The square has properties that have 4 symmetry axes, can occupy the frame in 8 ways, all four sides are equal, parallel facing sides, each angle is equal, the diagonals are equal in length, and the diagonals intersect perpendicular and halve the same length.

b. Rectangles on the motif of Malang Batik Artwork
Malang mask batik motif is an icon of the Malang city. This batik motif has a mask motif with various types of Malang masks. In addition, this batik motif is created with floral motifs, leaves, lotus, and many more. In the unfortunate mask stamp motif there is a rectangular concept.
Based on the Malang masked batik motif, the rectangular concept is obtained. A rectangle is a rectangular flat shape with all four corners representing a right angle and sides facing the same length. The rectangle has properties which have 2 symmetry axes and 2 rotate symmetry, can occupy the frame in 4 ways, the opposite sides are equal, the opposite sides are equal, each angle is equal, the diagonals are equal equal length, and diagonals intersect and divide by two equal lengths.

4. Conclusion
Ethnomatematics in batik artwork is a square and rectangular concept. Square and rectangle found in Malang batik art exploration. For example, kawung batik motifs and Malang batik are contained in a square concept. In addition, for example, the Malang masked batik motif has a rectangular concept. The concept of squares and rectangles in Malang batik motifs can be applied in mathematics learning. Especially in two-dimensional figure material. Thus, mathematics learning is more fun and more innovative.

Malang batik motifs can be used as alternative learning resources for students. In addition, students add knowledge and insight into mathematics that is related to one element of culture. Besides learning mathematics students also learn about the culture that developed in the Nusantara.

Acknowledgements
We would like to thank the Center for Research and Service to the community of IKIP Budi Utomo Malang. In addition, Malang batik and all those who helped this research.

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