

AN ETHNOMATHEMATICAL STUDY ON CONTEMPORARY BATIK DESIGN USING ALTERNATIVE RESISTANCE

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Article history

Received date : 18-4-2021
Revised date : 19-4-2021
Accepted date : 5-6-2021
Published date : 14-7-2021

To cite this document:

Wan Bakar, W. N., Awang, J., Ahmad, N. H., & Zawawi, M. Z. (2021). An Ethnomathematical Study on Contemporary Batik Design Using Alternative Resistance. *Journal of Islamic, Social, Economics and Development (JISED)*, 6 (37), 73 – 80.

Abstract: *Ethnomathematics is a study of the application of mathematical thinking into the culture of a group of people in a specific country. It is a new field of study and has given a lot of contribution to the country. In this paper, the ethnomathematics study is focusing on motifs of contemporary batik design by using alternative resistance, which is a new resistance tool that has such as iron brush, copper cake mold, paper box, and wooden broom was invented by Mr. Junaidi Awang, the lecturer of Art and Design, UiTMCK. This new invention is purposely designed to help the poor and skillful batik workers to do the batik design. It is qualitative research by employing the triangulation method to comprising observation, interview, analysis of the motifs on contemporary batik designs via alternative resistance. The results showed that by using an iron brush the resulting motifs are circles arranged in a tessellation. By using copper cake mold, the motifs produced are hexagons arranged in tessellation and rotation. By using a paper box, the motifs created are half square-shaped arranged in tessellation, and last but not least by using a wooden broom, circle-shaped motifs exist arranged in tessellation. It is suggested that future research can be applied to readily available and cost-effective recycled materials.*

Keywords: *Ethnomathematics, Contemporary Batik Design, Alternative Resistance.*

Introduction

Ethnomathematics is a study of the mathematical thinking of a group of people in a specific country. Malaysia, for instance, is a country that has different communities and diverse cultures. One of the biggest communities in Malaysia. The Malays living on the east coast of Malaysia designed batik. Malays are artistic who inadvertently apply mathematical concepts in their work. This culture of batik design can be used to explore the mathematical concept to bring mathematics close to reality. The motifs used on the batik and the way it is arranged show the uniformity of the batik fabric. a uniform pattern can attract the attention of customers because it looks neat and orderly arranged. There are 3 main types of textile art namely woven textiles, printed textiles, and batik textiles.

Woven textiles are patterns produced through weaving techniques, printed textiles are patterns produced throughout printing techniques and batik textiles are produced through resistance techniques.

Textile art is an art full of beauty. In the art of batik, the pattern design produced will go through two main processes, namely resistance, and dyeing where the fabric will first be applied resistant material before it is dyed-through dyeing or dyeing by swiipe.

The resistant material that is usually used in batik art is wax where it serves as resistant material so that the fabric does not enter the color. Therefore, the batik fabric must be waxed before being dyed. The resistant tool is important because it acts as a retainer to the staining and a determinant of the resulting pattern.

Among the common resistant techniques in batik art are stamping and also chanting. The fabric will first go through the process of stamping the motif using a stamp tool or drawing the motif through a chanting tool before being colored by dipping the entire fabric or coloring it with a brush. The pattern will only be visible after the staining process is performed.

Ethnomathematics is a form of mathematics that is influenced or based on culture. In this concept, Ethnomathematics is a program that investigates how different cultural groups comprehend, articulate, and apply ideas and concepts that can be identified as mathematical practices. Ethnomathematics is perceived as a lens to see and understand mathematics as a culture. (Ambarawati, 2019)

Ethnomathematics encourages us to witness and attempt to understand how mathematics continues to be adopted and used by people around the world. (Linda H.L, Furuto, 2013)

The basic concept in Ethnomathematics is geometry. It is concerned with shapes, sizes and relative position of figures, and the properties of space. (Bakhrul Ulum, 2017)

They are four concepts in geometry. They are:

- a. Tessellation is the covering of a plane using more geometric shapes called tiles with no gaps.
- b. Points are considered a fundamental concept of geometry.
- c. Lines are the breadthless length that lines equally with the points on itself.
- d. A plane is a dimensional surface that extends infinitely far.
- e. An angle is a figure formed by 2 rays, that is the side angle and the vertex angle, and shared a common point.

- f. Symmetry in Euclidean geometry is represented by congruence and rigid motions. 2 figures are congruent if they have some shape and size.
- g. A reflection is a mapping from a Euclidean space to itself that is an isometry. (Popov, 2001)
- h. A translation means moving without resizing or rotating. Every point of the shape must move in the same direction and at the same distance. The initial object is the pre-image and the next object in the image. (Whittaker, 1988)

Research on Ethnomathematics and Batik Designs

They are few recent researchers focusing on Ethnomathematics in contemporary batik design. Irma Risdiyanti, Rully Charitas and Indra Prahmana (2017) has made an ethnomathematics exploration in batik making in Yogyakarta. They found that Yogyakarta batik contains philosophy, deep cultural value, and the mathematical concept of transformations.

Melindawati, Kusuma Anggraen and Mardiyana (2018) surveyed on Geometric Transformation in Surakarta Batik Patterns. They found that Surakarta Batik Patterns were influenced by the culture of the palace and were formed by the combination of Javanese, Islam, Hindu, and Buddhism. The geometric transformation found in Surakarta Batik was the reflection, translation, rotation, and dilatation.

Yulia Erniwati (2019) did Ethnomathematical research in Batik Gedog Tuban which was a famous batik in Tuban, Indonesia. The results show that there were several mathematical concepts in Batik Gedog Tuban, such as geometry concepts, transformation, and congruence. Mika Ambarawati, Ririn Dwi Augustino (2019) explored the ethnomathematical study of Malang Batik Art and found that in Malang motifs, there was the concept of a 2-dimensional figure and it can be applied in learning models.

Sukmawati Nur Endah, Suhartono Suhartono Retno Kusumaningrum and Roihan Auliya Ulfattah (2020) had further applied computer technology by using triangle mesh to generate 3D motifs of Indonesian Batik.

Based on the results of unit testing and usability testing it has fulfilled the functional requirement and the design had been preparing implemental by the user.

Rully Charitas, Indra Prahman, and Ubiratas D' Ambrosio (2020) did an ethnomathematical study on Batik Patterns of Yogyakarta, Indonesia. The study indicates that Yogyakarta Batik uses the concept of geometry transformation in making Yogyakarta's unique motif. Each motif contains local values namely moral, historical, and philosophical values that can be applied in daily life such as leadership, good deeds, and so on.

N Fathikin and P Wijayawanti (2020) explored ethnomathematical study on Ngawi Batik to unlock philosophy values and mathematical concepts. The result shows that Ngawi Batik has philosophical values, namely, the history of Ngawi which is the combination of bamboo motifs and the use of mathematical concepts such as symmetry, transformation, and congruence.

Problem Statements

The batik industry is facing major challenges which are high batik manufacturing costs such as raw material costs, equipment costs, wage costs, and marketing costs.

For the equipment, the cost of a unit of a copper block is between RM300 and RM800. This will definitely burden the lower-class worker. The price of a copper block will be more expensive if high-quality copper and intricate patterns are used. Moreover, each copper block has to be ordered from a batik copper block maker who takes quite a long to complete making it.

Another problem that arises in the batik industry is that the patterns produced on the fabric are patterns carved by batik blocks only and cannot be diversified causing them to look static. While for batik printing that uses ‘chanting’ only one line is produced each time a painting is made on the surface of the batik.

Due to the above-mentioned factors, many skilled but incapable people cannot open their businesses. According to the Annual Report of Malaysian Handicrafts in 2018 shows that there are more than 1500 batik workers in the state of Kelantan who are skilled but can only work for a living with employers because they cannot afford to open batik companies that require high capital.

This issue is supported by Tuan Haji Kamaruzaman Osman from East Cost Batik Association in Kelantan (2019) who said that the development of batik making is relatively static, requiring new techniques or innovations even more so in the era of increasing cost production.

Prof Dr. Khairul Azlin from the Faculty of Industrial Design University Putra Malaysia (UPM) said that the dependence on existing conventional techniques will hinder the development of batik innovation in Malaysia.

Malaysia batik artists still lack creativity in the exploration of materials because they still rely solely on one existing material in the production of batik, Emylia Tan Painting Artist in The Managing Director of Batik Magazine (2018).

Due to this phenomenon that had happened in the batik industry in Malaysia, it is a dire need for researchers to find alternative resistance which may save cost and time and at the same time produce good and quality batik.

Research Objectives

1. This study identifies whether the designs have Ethnomathematical features through the use alternative resistance.
2. This study identifies the alternative resistance that have cost and time saving features.

Research Questions

1. What are the ethnomathematical features of the designs that use the alternative resistance.
2. What are the alternative resistance that have cost and time saving features?

Methodology

Since the objective of this research is to analyze the motifs of the contemporary batik design using alternative resistance, the qualitative study method was chosen. We have selected a respondent to be interviewed.

The respondent is Mr. Junaidi Awang, Senior Lecturer from the Faculty of Art and Design, majoring in Textile Design, UiTM Campus Kelantan. He has won many awards for his innovation. Mr. Junaidi Awang was assisted by a team of two lecturers in the Faculty of Art and Design.

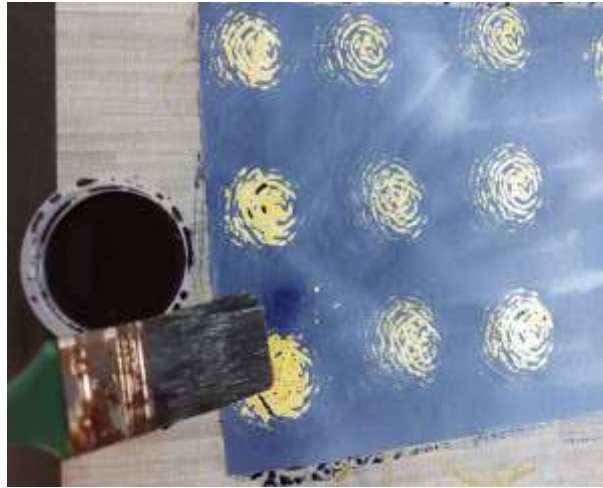
To achieve the research objective, a triangulation method consisting of observation, analysis, and the interview was employed to collect primary data.

An observation of geometrical design covering the size, arrangement, frequency patterns, and symmetrical lines of the contemporary batik design using alternative resistance through photos and products was conducted. The input obtained was then analyzed to acquire the geometrical concept of the contemporary batik design using alternative resistance.

An interview with Mr. Junaidi Awang who designed the motifs was conducted. Meanwhile, secondary data was collected from websites.

Data Analysis

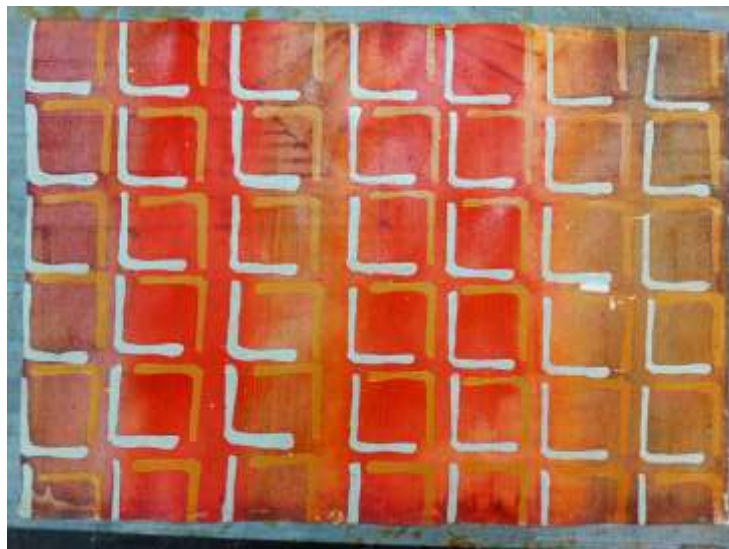
1. The motif using iron brush.



2. The motif using copper cake mold.



3. The motifs using paper box.



4. The motifs using wooden broom.



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