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Learning Number Patterns through Batik and Webbing Motifs: An Ethnomathematics Study in Kudus

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Abstract

Number pattern learning lacks a link to everyday life. This research aims to find the concept of number patterns in batik and weaving motifs in the Japanese village of Kudus Regency. Qualitative approach with ethnographic model was used in this research. The subjects of this research were woven craftsmen in Japanese village, batik craftsmen in Alfa Shoofa Batik Kudus and Muria Batik Kudus. Data collection techniques used interviews, observation, and documentation with research instruments in the form of interview guidelines, documentation, and field notes. The results of the research found the concept of arithmetic sequence in Kudus batik motifs. Kudus batik motifs form an arithmetic sequence with a difference of 6 and a difference of 3. In addition, odd and even number sequence patterns were found. Meanwhile, in the weaving of the Japanese village community, an arithmetic sequence with the formula Un = 2n -1 (odd number pattern) and Un = 2n (even number pattern) was found. The research findings can be developed as a learning resource for number patterns in mathematics learning.

Keywords: Webbing; Batik Kudus; Kudus Culture; Ethnomathematics; Number Patterns

Abstrak

Pembelajaran pola bilangan kurang mengaitkan dengan kehidupan sehari-hari. Penelitian ini bertujuan untuk menemukan konsep pola bilangan pada motif batik dan anyaman di desa Jepang Kabupaten Kudus. Pendekatan kualitatif dengan model etnografi digunakan dalam penelitian ini. Subjek penelitian ini adalah pengrajin anyaman di desa jepang, pengrajin batik di Alfa Shoofa Batik Kudus dan Muria Batik Kudus. Teknik pengumpulan data menggunakan teknik wawancara, observasi, dan dokumentasi dengan instrumen penelitian berupa pedoman wawancara, dokumentasi, dan catatan lapangan. Hasil penelitian ditemukan konsep barisan aritmatika pada motif batik Kudus. Motif batik Kudus membentuk barisan aritmatika dengan beda 6 dan beda 3. Selain itu, ditemukan pola barisan bilangan ganjil, dan genap. Sementara pada anyaman masyarakat Desa Jepang ditemukan barisan

aritmatika dengan rumus Un = 2n -1 (pola bilangan ganjil) dan Un = 2n (pola bilangan genap). Temuan penelitian dapat dikembangkan sebagai sumber belajar pola bilangan pada pembelajaran matematika.

Kata Kunci: Anyaman; Batik Kudus; Budaya Kudus; Etnomatematika; Pola Bilangan

Introduction

Consciously or not, one part of the process of learning mathematics for students is to develop and apply mathematical concepts based on real-life problems (Tanujaya, et al., 2017; Wahyu, et al., 2017). This statement is also in line with what Freudhental (2006) explained that, mathematics is a human activity and mathematics must be related to human daily life. Contrary to this statement, the fact is that there are students who have not been able to use mathematics in solving the problems of everyday life, as a result the community rationally views that mathematics has nothing to do with culture and real life (Putra, Herman, & Sumarmo, 2017). These problems are a challenge for Tadris Mathematics students as prospective mathematics teachers. Before teaching mathematics to students, prospective mathematics teachers must be prepared to have a mindset that mathematics is related to culture and everyday life. One way to prepare the mindset of prospective mathematics teachers is through the learning process in lectures.

In relation to the concept of mathematics which is close to real life and culture, Abdullah (2016) revealed that the mathematics learning process requires a bridge that connects mathematics with real life and culture, namely ethnomathematics. This is also explained by Rahmawati & Muchlian (2019) that ethnomathematics is a bridge between culture and education, especially mathematics education. Ethnomathematics was first coined by D'Ambrosio (1985) with the aim of carrying out mathematics by paying attention to the development of academic knowledge in the realm of diverse cultures and societies. Ethnomathematics is the specific habits used by a cultural group or a group of people in mathematical activities. What is meant by mathematical activities are counting, measuring, designing buildings or tools, making patterns, classifying, determining locations, explaining, calculating, and so on (Rachmawati, 2012: 1).

Number pattern is one of the compulsory materials that are learnt in schools and even universities. Number pattern material is one of the inductive reasoning that is often found in mathematics. Students can use inductive reasoning to find mathematical relationships through learning patterns (Sari, et., 2016). The results indicate that the difficulties experienced by students in solving number pattern problems are (1) determining patterns and structures to detect regularities, (2)

formulating generalisations from conjectures about observed regularities, (3) evaluating conjectures, and (4) constructing and evaluating mathematical arguments (Sari, et., 2016). In addition, the results of research by Ariyanti and Setiawan (2019) found student difficulties when solving number pattern problems, namely, 1) students have difficulty determining the pattern in the problem, 2) students have difficulty in formulating generalizations from the regularity or pattern of numbers, 3) students are too focused on the formula. Reflecting on the problems that have been stated. There is a need for special measures to teach number pattern material.

Indonesia is a country that has different cultural diversity, including Kudus Regency. Kudus is known by various nicknames, including the city of santri, the city of kretek until there is a dance called kretek dance, and the city of Jerusalem van java. Kudus is also known to hold a variety of cultures. Based on data from the Kudus Culture and Tourism Office (2018), there are 11 cultural elements consisting of oral traditions, manuscripts, customs, rites, traditional knowledge, traditional technology, arts, languages, folk games, traditional sports, and cultural heritage. The variety of cultures in Kudus can be a bridge that connects mathematics learning with everyday life. Thus, students realise that mathematics is close to life. Therefore, research is needed that takes the role of exploring the concept of number patterns in batik and weaving typical of Kudus. Through this ethnomathematics research that will be applied to students, dialogues will certainly emerge and there will be respect for students' different opinions in the process of learning number patterns. This can revive the attitude of justice in students and can foster an attitude of tolerance for the differences encountered from a variety of cultures and knowledge. The attitude of justice and tolerance is a concrete manifestation of the practice of applied Islam.

Several studies related to ethnomathematics in Kudus Regency have been conducted. These studies include Ulya and Rahayu (2017), Masamah (2019), Auliya (2019), Wahid, Handayanto, and Purwosetiyono (2020). The four studies examined ethnomathematics to be applied at the primary education level based on one culture in Kudus Regency and applied to geometry learning. Meanwhile, this research has its own uniqueness, namely, exploring the ethnomathematics of the local culture of the Kudus Regency community related to number patterns to be applied to mathematics learning. It is hoped that the results of this research can be used as a context in making learning designs, so as to create a learning design for learning number patterns that is fun, close to students' daily lives and contains cultural values that can shape student character.

Method

A qualitative approach with an ethnographic model was used in this research. This is because this study aims to explore the concept of number patterns in batik and plaiting in the Japanese village of Kudus Regency. The subjects of this research are woven craftsmen in Japanese village, batik craftsmen in Alfa Shoofa Batik Kudus and Muria Batik Kudus. The data were obtained through observation, interview, and documentation. The interview instrument is in the form of an interview guideline which is useful for collecting information related to the form of batik and woven motifs in kudus district. In addition, it was strengthened with observation sheet instruments and field notes to obtain research data. Furthermore, the data validity test uses method triangulation techniques and source triangulation techniques. Data on batik motifs and woven motifs that have been obtained are analysed using the Miles and Huberman model which consists of data reduction, data presentation, and conclusion drawing.

Results

Most Kudus batik motifs depict plant and animal forms. Kudus batik motifs are heavily influenced by the development of Islam, Dutch and Chinese in Kudus. The origin of Kudus batik began to develop in Langar Dalem Village around Kudus Tower. Kudus batik has a role in the spread of Islam in Kudus. Sunan Kudus used Kudus batik as a medium of da'wah in spreading the teachings of Islam in Kudus. Kudus batik motifs are influenced by Chinese civilisation or from the coastal areas, such as kudus city, pati, lasem. Kudus batik itself once existed, before other batik also had a few years of vacuum.

There is also a batik association called Kobain. Kobain is a kind of cooperative that produces and provides batik and its materials. Batik Kudus itself was once vacuumed because batik entrepreneurs in Kudus could not coordinate the next generation because batik entrepreneurs in Kudus used to be in one place. Only in the early 2000s did batik production emerge, such as muria batik, alfa shofa and others. Apart from the lack of preparing to coordinate the next generation, Kudus batik was also defeated by embroidery which at that time was on the rise. However, it did not last long, so the embroidery business was directed by the government to develop Kudus batik. Then including djanoer batik for about five years. Djanoer batik produces modern batik while Omah batik in Jagalan produces and inherits classic batik. The classic batik model is patent and cannot be changed from the original form, be it the colour or anything else.

Number Patterns in Kudus Batik

Kawung Kretek Motifs

Take a look at the kawung kretek batik motif below (see Figure 1).

Figure 1. Kawung Kretek Motifs

Suppose Image  is motif A and Image  is motif B

The image of motif A (see Figure 1) occupies positions 1, 3, 5, 7, 9, ... This means that each tribe for motif pattern A has a difference of 2 with the next tribe. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 2 then for the nth tribe can be obtained Un = 2n - 1. This means that motif A forms an odd number pattern.

While the motif B image (see Figure 1) occupies positions 2, 4, 6, 8, 10 ... This means that each tribe for motif B pattern has a difference of 2 with the next tribe. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 2 then for the nth term can be obtained Un = 2n. In other words, motif B forms an even number sequence pattern.

Tandas Ship Motifs

Furthermore, consider the following batik motif of the tandas ship.

Figure 2. Tandas Ship Motifs

Suppose Image  is motif C

Based on Figure 2, motif C occupies positions 1, 7, 13, ... This means that each tribe for motif C pattern has a difference of 6 with the next tribe. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 6 then for the nth tribe can be obtained Un = 6n - 5.

Calligraphy Motifs

Take a look at the calligraphy motif in Figure 3 below.

Figure 3. Tandas Ship Motifs

Assuming Image  is motif D and Image  is motif E

Referring to Figure 3, it can be seen that motif D occupies positions 1, 3, 5, 7, 9, ... This means that each tribe for motif pattern D has a difference of 2 with the next tribe. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 2 then for the nth tribe can be obtained Un = 2n - 1. This means that motif D forms an odd number pattern.

While the motif E image (see Figure 3) occupies positions 2, 4, 6, 8, 10 ... This means that each tribe for motif E pattern has a difference of 2 with the next tribe. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 2 then for the nth term can be obtained Un = 2n. In other words, motif E forms an even number sequence pattern.

Hajj Fern Motifs

Take a look at the Hajj fern motif in Figure 4 below.

Figure 4. Hajj Fern Motifs

Denote Image  is a motif of F

Referring to Figure 4, it can be seen that motif F occupies positions 1, 4, 7, ... This means that each term for motif F pattern has a difference of 3 with the next term. If adjusted to the pattern of the arithmetic sequence with a difference or difference of 3 then for the nth tribe can be obtained Un = 3n - 2.

Japanese Village Wickerwork Crafts

When examined, woven crafts have a pattern for their manufacture. This is the basis for researching woven crafts as a context for learning number patterns.

Number Patterns with a Wicker Craft Approach

Number pattern can be interpreted as an arrangement that has a regular shape from one form to the next. While the number is something that is used to indicate the quantity and size of an object. So, the number pattern can be interpreted as an arrangement of numbers that have a regular shape from one form to the next. One of the ethnomathematics approaches to number patterns is with woven crafts.

Japanese village weaving has several varieties in daily life, such as: tampah, kreneng, tambir, and so on as shown in Figure 5 below.

(i) (ii) (iii)

Figure 5 (i) Tampah, (ii) Kreneng, (iii) Tambir

According to the known motifs, weaving patterns can be designed. As for some patterns of woven motifs, they are as in Figure 6 below:

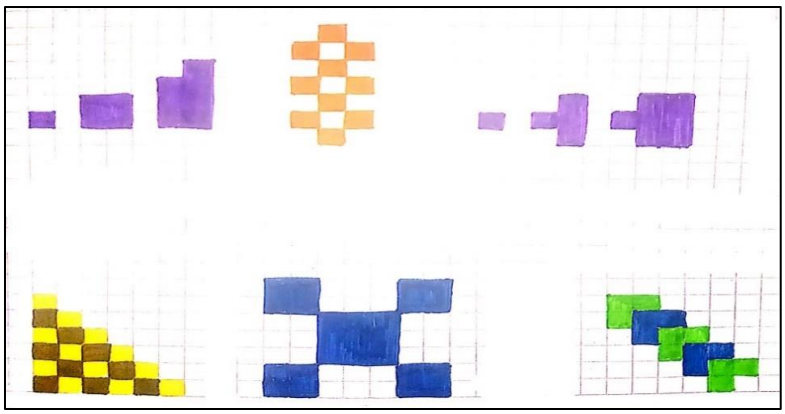
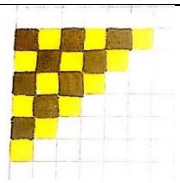
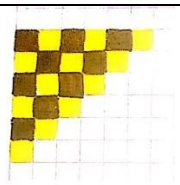
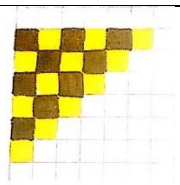
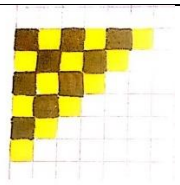


Figure 6. Woven Motif Patterns

The following Table 1 describes in more detail the concept of number patterns in Japanese Village weavings.

Table 1 Number Patterns in Japanese Village Webbing

Japanese Village Webbing	Webbing Pattern	Number Patterns	How to Calculate
Rantang Maulid 		First row The brown squares occupy positions 1, 3, 5, ... Second row The brown squares occupy positions 2, 4, 6, ...	First Row of Odd Number Patterns (Un = 2n-1) First Row of Even Number Patterns (Un = 2n)
Kreneng 		First row The brown squares occupy positions 1, 3, 5, ... Second row The brown squares occupy positions 2, 4, 6, ...	First Row of Odd Number Patterns (Un = 2n-1) First Row of Even Number Patterns (Un = 2n)
Tambir 		First row The brown squares occupy positions 1, 3, 5, ... Second row The brown squares occupy positions 2, 4, 6, ...	First Row of Odd Number Patterns (Un = 2n-1) First Row of Even Number Patterns (Un = 2n)
Tampah 		First row The brown squares occupy positions 1, 3, 5, ... Second row The brown squares occupy positions 2, 4, 6, ...	First Row of Odd Number Patterns (Un = 2n-1) First Row of Even Number Patterns (Un = 2n)

According to Table 1, there is an odd number pattern, Un = 2n-1, and an even number pattern, Un = 2n, in the variety of Japanese woven villages developed in Kudus.

Discussion

Ethnomathematics is the basic concepts of mathematics such as making patterns, calculating, and predicting in local cultures (Kurniawan et al., 2019: 3). Culture is the thoughts, works, and human products that are not rooted in their instincts which are only implemented after the learning process (Koentjaraningrat, 2004). Elements of culture include: religion and religious ceremonies, community organisation, knowledge, language, arts, livelihoods, and technology and equipment systems. In the element of art, one example is woven crafts. Wickerwork is a handicraft object with weaving techniques, namely by overlapping, cross-crossing, folding, and so on made from various kinds of materials (Maryati et al., 2020).

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Conclusion

The findings of the research reveal that there is a concept of arithmetic sequence in the Kudus batik motif of kawung kretek, ship tandas motif, calligraphy motif, and hajj fern motif. The arithmetic sequence in Kudus batik motifs forms an odd number sequence pattern, an even number sequence, an arithmetic sequence with a difference of 6 and a difference of 3. In addition, the analysis results reveal the existence of an odd number sequence pattern and an even number sequence pattern in the woven motifs made by the Japanese Village community of Kudus Regency. These patterns are found in the woven forms of kreneng, tambir, tampah, and rantang maulid. This research is certainly inseparable from the limitations in the form of a study of mathematical concepts that only discuss number patterns. It

is hoped that other researchers can develop the results of this research on other mathematical concepts.

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