International Journal of Trends in Mathematics Education Research
Vol. 7, No. 1 (2024), pp. 25~35
ISSN 2621-8488 (online)
DOI: https://doi.org/10.33122/ijtmer.v7i1.316

SAINTIS publishing

Research Article

Exploration of ethnomathematics in Riau Malay Songket

Nurul Huda Zuhdi & Reflina

Universitas Islam Negeri Sumatera Utara, Medan, Indonesia
*Corresponding Author: nurul0305203110@uinsu.ac.id, reflina@uinsu.ac.id

Received: 5 June 2024 *Revised: 20 June 2024* *Accepted: 25 June 2024* *Available online: 13 August 2024*

ABSTRACT

This research is a qualitative study using an ethnographic method, aiming to identify the mathematical concepts embedded in the Riau Malay Songket motifs. The study was conducted at Dekranasda Riau Province, located at Jalan Sisingamangaraja No. 140, Pekanbaru City, Riau Province. The subject of the study is a weaver working at Dekranasda Riau Province. The research instruments are divided into two categories: the main instrument and the auxiliary instruments. The main instrument used is the interview guideline, while the auxiliary instruments include observation sheets and field documentation sheets. The data analysis techniques employed in this study are data reduction, data presentation, and drawing conclusions. The results of this study reveal mathematical concepts within the traditional Riau Songket motifs, including shapes such as triangles, ribs, circles, tubes, angular shapes, parallel lines, dots, reflections, dilations, and number patterns. This demonstrates that mathematics is inherent and develops within certain societal activities, which is referred to as ethnomathematics.

Keywords: exploration; ethnomathematics; songket; riau; mathematical concepts

1. INTRODUCTION

Indonesia is renowned for its rich and diverse cultural heritage, encompassing a wide range of traditional arts, crafts, and practices that have been passed down through generations (Mendoca et al., 2021). Among these, the art of weaving, particularly the creation of intricate songket fabrics, holds a special place in the cultural identity of many Indonesian communities, including the Riau Malay. However, in recent years, the influence of globalization and modern fashion trends has led to a gradual decline in the appreciation and understanding of these traditional crafts, especially among the younger generation. Many of today's youth are increasingly drawn to foreign clothing products, which are often perceived as more modern and stylish, overshadowing the beauty and cultural significance of traditional Indonesian woven fabrics.

This shift in preferences and the subsequent fading of cultural knowledge pose a significant threat to the preservation of Indonesia's intangible cultural heritage. The traditional art of songket weaving, with its deep cultural roots and symbolic motifs, risks being forgotten if it is not actively preserved and promoted. The Riau Malay songket, in particular, is a rich repository of cultural and mathematical knowledge, embedded in its complex patterns and designs. These motifs are not merely decorative; they represent a unique form of ethnomathematics, where mathematical concepts are intertwined with cultural expressions.

If this trend continues, there is a high likelihood that not only the craft of songket weaving will decline, but also the rich cultural narratives and mathematical wisdom embedded within these textiles will be lost. The loss would not only affect the cultural identity of the Riau Malay community but also diminish the broader understanding of how traditional cultures integrate mathematical thinking into their artistic practices. Therefore, it is crucial to explore and document the ethnomathematics inherent in Riau Malay songket as a way to preserve and revitalize this valuable aspect of Indonesia's cultural heritage.

This research aims to explore the mathematical concepts contained within the motifs of Riau Malay songket, highlighting the intersection of culture and mathematics in this traditional craft. By understanding and promoting the ethnomathematics of Riau Malay songket, we can contribute to the preservation of Indonesia's cultural heritage and ensure that future generations appreciate and continue these time-honored traditions.

Since ancient times, humans have applied mathematics in their lives through various approaches (Syahriannur, 2019). Within the context of culture, ethnomathematics can serve as a bridge to understanding mathematical concepts. Ethnomathematics is rooted in and thrives within the culture of a society (Aini, 2018). It represents the mathematics that develops and functions within a community, in harmony with its local culture (Arjun, 2021). Ethnomathematics involves integrating the subject matter, lifestyle, and existing local culture into learning (Zaenuri et al., 2018). Moreover, it can be said that ethnomathematics has a positive impact, as it offers an alternative approach to mathematics learning and plays a crucial role in introducing culture, especially within an educational context (Surat, 2018).

The study of ethnomathematics in education encompasses various fields, including architecture, tailoring, ornamentation, spiritual life, and creative thinking, all of which evolve alongside the times (Rahmadani & Reflina, 2023). This research on ethnomathematics in mathematics education focuses specifically on the field of weaving. According to historical records, the art of weaving known in the Riau Malay community was first introduced by a craftsman from the Kingdom of Terengganu, Malaysia, during the reign of Sultan Sayid Ali in the Kingdom of Siak. Wan Siti Binti Wan Karim, an experienced weaver from Terengganu, was brought to Siak Sri Indrapura to teach songket weaving techniques. This was an effort to enrich the local knowledge of weaving in Riau (Dekranasda Prov Riau, 2008).

One example of culture found in the Riau region, particularly in Pekanbaru, is songket cloth. Woven fabrics play a significant role not only in cultural practices but also in economic activities as a commercialized commodity (Asmidar & Prihatin, 2023). The use of songket cloth extends beyond royal or special events; it also serves as a symbol of pride for the city of Pekanbaru. A notable example is the Longest Malay Songket Shine Monument in Pekanbaru, located on SM Amin Street, which has become an icon imbued with values of honor and respect.

Figure 1. Songket Monument in Riau

There are several types of motifs in the Riau Songket, including the bamboo shoot motif, mangosteen tail, cloud elbow, and keluang elbow. The bamboo shoot motif symbolizes fertility and patience, characterized by the shape of a newly sprouted shoot, tapering towards the tip (Mentari & Rosandini, 2019). Similarly, other motifs carry their own distinct meanings.

The mathematical concepts to be explored in this Songket include identifying geometric shapes, geometric transformations, numbers, parallel lines, and angular points. Further research may reveal additional mathematical concepts embedded in some of the Songket motifs. Understanding these concepts helps us realize the significance of what surrounds us. By starting with something as simple as Songket, the younger generation can learn about and appreciate the cultural heritage that has been passed down in the city of Pekanbaru. Based on the background of the problem described above, the purpose of this study is to identify the mathematical concepts embedded in the Riau Malay Songket motifs. The author is therefore interested in conducting research titled "Exploration of Ethnomathematics in Riau Malay Songket."

2. RESEARCH METHOD

This research emphasizes qualitative research, where direct data is field research. Field research has revealed the facts of social welfare of community cultivation. According to (John W. Cresswell, 2017) qualitative research is an approach to explore and understand meaning by individuals who come from social problems. The meitodei peineilitian that is guinized is the ethnographic meitodei. Ethnography is used to describe, explain and analyze the socio-cultural components of a society or ethnic group (Genton Randan, 2022). This research was conducted to explore the use of the concept of flat building and geometric transformation in songket fabric motifs.

In this study, the subject of the study was a weaver in Dekranasda Prov. Riau who is skilled and understands the motives on songket well to obtain the right information. The location in this study is in Dekranasda Prov. Riau, Jalan sisingamangaraja No. 140 Pekanbaru City, Riau Province. The location was chosen as a research site because the location is one of the places that still preserves Riau's typical songket. The researcher collected information directly and was strengthened and deepened by the researcher's observation, hearing, perception, and personal understanding of Riau songket. In this study, data collection instruments are divided into two types, namely main instruments and auxiliary instruments. The main instrument used is the interview guideline, while the auxiliary instruments include observation sheets and field documentation sheets. According to (Miles & Huberman 1992) the data analysis technique used in this study is data reduction, which is the process of selecting and sorting information relevant to the research question. Furthermore, the presentation of data, which is the process of organizing the information that has been collected in a clear and systematic form, and finally drawing conclusions, namely providing an explanation of the description of the answers to the researcher's questions in accordance with the findings of the research results obtained during the research process that forms a conclusion from the observations that have been made.

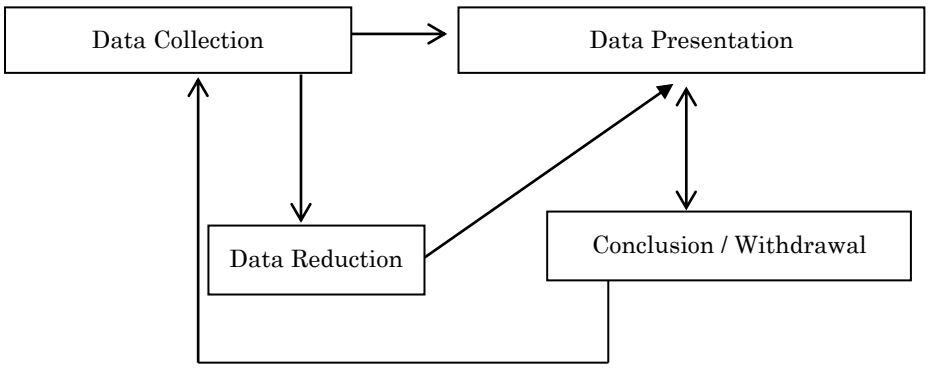


Figure 2. Data Analysis Technique Chart (Miles & Huberman 1992)

3. RESULTS AND DISCUSSION

Based on the results of data collection from the songket motif of bamboo shoots, mangosteen elbows, cloud elbows, and keluang elbows, the following ethnomathematical studies were obtained.

3.1 Ethnomatematics study

1. Making process

The process of making it is by collecting several threads and rolling them on bamboo strips. Then the collection of threads on the bamboo is arranged together with other threads until it reaches a length of 20-30 m, and rolled on a winding tool placed at the end of the Kik.

Figure 3. Thread Place (Kik)

This thread holder is made of wood consisting of 13 columns, each of which consists of 18 thread holders.

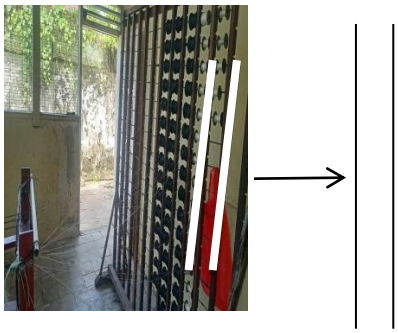
Figure 4. Winding machine (Milling process)

This process is called harvesting. This tool is made of teak wood, then shaped like a tube which aims to be able to simplify the winding process. Furthermore, this thread is stretched lengthwise along the length of Kik and the thread that stretches lengthwise is called a thread or longsi.

Figure 5. Torak

After completion, the threads are rolled into a tool used to place the yarn on the loom called a torak. In figure 3 there is a parallel line. An parallel line is a position of two lines on a flat plane that does not have a cut point even though the two lines are extended. The properties of parallel lines are:

1) Two lines that are parallel to each other have no intersection points.
2) Two parallel lines will be on the same plane.

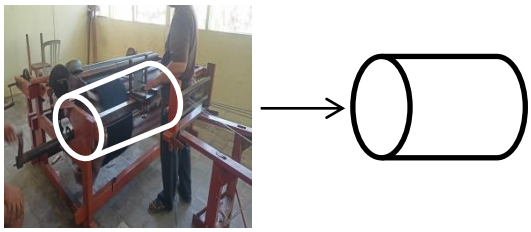


(a) (b)

Figure 6. (a) Thread Place (Kik), (b) Parallel line

In Figure 6, there is the shape of a tube. The tube is an upright prism that has a spiral-shaped base. The properties of the tube are:

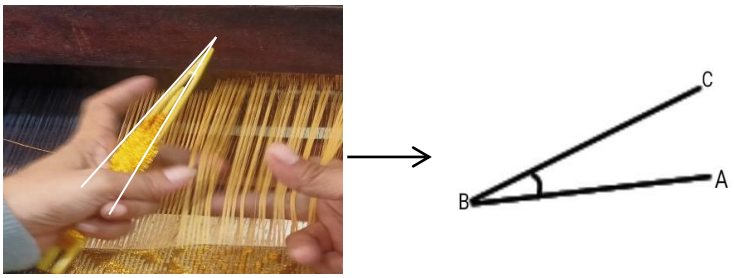
1) The height of the tube is the distance between the base circle and the lid circle.
2) Has 2 circular sides (lid and base) and 1 curved side (tube blanket)
3) It has no corner points.



(a) (b)

Figure 7. (a) Rolling machine, (b) Tube

In figure 4 there is a pointed corner. A taper angle is an angle that has a magnitude less than $90°$ or rather the magnitude of the taper angle is between to less than. If denoted as x, it is the amount of angle measured.$0°90°0° < x < 90°$



(a) (b)

Figure 8. (a) Torque (b) Pointed angle.

2. The results of the songket woven fabric motif

Based on the results of the research, there are 4 special motifs on the Riau songket, namely the shoots of mangosteen shoots, cloud elbows and keluang elbows.

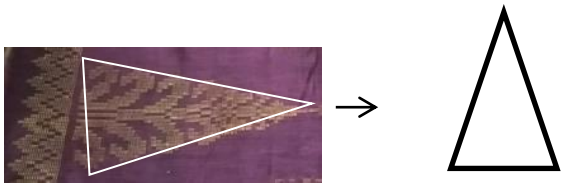
1) Songket Pucuk Rebait Motif

Bamboo shoots of the Rice variety are bowed. Rice is a staple food. Part of the motif of rice shoots, rice seeds that duck because they are ripe and rice fronds. And the triangular plane on the rice symbolizes bamboo shoot shoots. The meaning of this motive is higher the knowledge, the more humble it is, don't be arrogant and always humble.

Figure 9. Bamboo shoot motif

In this motif there are isosceles triangles, rhombuses, reflections and dilation.

a. Equilateral Triangle

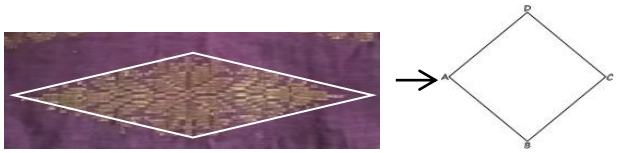


(a) (b)

Figure 10. (a) Bamboo shoot motif, (b) Isosceles Triangle Shape

In making the motif by drawing on mili paper, then it is formed according to the motif where the threads are inserted at the same distance so that it forms an isosceles triangle. An isosceles triangle is a triangle whose two sides are of equal length and there are 2 angles of equal magnitude, namely 2 angles facing each other with sides of the same length.

b. Rhombus shape



(a) (b)

Figure 11. (a) Bamboo shoot motif, (b) Rhombus shape

Likewise with this motif, it is formed according to the motif where the threads are inserted at the same distance so that they form a rhombus. A rhombus is one of the flat shapes composed of 4 sides of equal length and facing angles of equal size. All four sides are of equal length. Side AB = side BC = side CD = side DA, side AB is parallel to side CD, side BC is parallel to side DA. For angles that are equal to each other and divided by their diagonals into two equals, two equal lengths and perpendicular to each other.

c. Reflection

(a) (b)

Figure 12. (a) Bamboo shoot motif, (b) Reflection form

Reflection is a transformation that moves each point in the plane by applying the properties of the mirror shadow where the distance from the origin point to the mirror is equal to the distance from the mirror point to the shadow, there are several types of reflection, namely reflection on the x-axis, reflection on the y-axis and reflection on the origin point (0.0). The garuda motif reflects on the y-axis or on the x-= h axis. If the located motif is at point A(x,y) by being reflected by the y axis or x = h, then the shadow will complement the motif so that it becomes a complete motif. If the point A(x,y) is reflected on the y-axis, then the coordinates of the shadow are A'(-x,y). If point A (x,y) is reflected on the x = h axis, then the coordinates of the shadow are A'(2h - x, y). When notated into mathematics then:

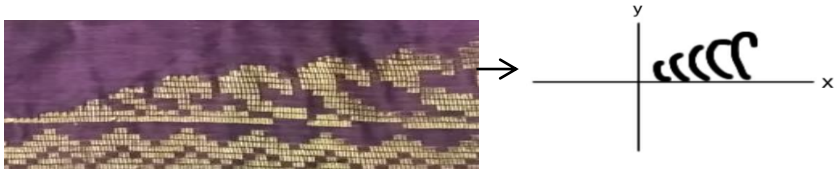
The point A(x,y) is reflected on the y-axis, so the coordinates of the shadow are A'(-x,y) written with:

$$A\,(x,y) \xrightarrow{Axis\ y} A'(-x,y)$$

Point A(x,y) reflected on the axis x = h, then the coordinates of the shadow are A'(2h - x, y) written with

$$A\,(x,y) \xrightarrow{Axis\ x=y} A'(2h-x,y)$$

d. Dilation



(a) (b)

Figure 13. (a) Bamboo shoot motif, (b) Dilatation form

Transformation dilation is the process of resizing (enlarging or shrinking) a geometric object without changing its shape. If k > 1, it includes enlargement dilatation, and if 0 < k < 1 includes enlargement dilatation.

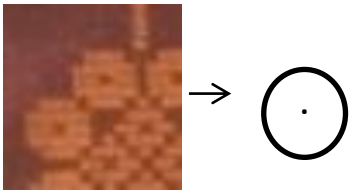
2) Songket Tampuk Mangosteen Motif

Tampuk Mangosteen is a variation of cloves that have 4-8 petals, so the Clove Flower Mangosteen Stack motif has 4-8 petals. The meaning of this motif is that cloves are classified as small flowers but rich in benefits. Likewise, living a lack can be an advantage.

Figure 14. Mangosteen Motif

In this motif there are Dots, Parallel lines, Ribs and Circles.

1. Point



(a) (b)

Figure 15. (a) Mangosteen Motif, (b) Point

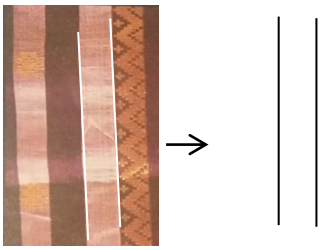
Dots are undefined, shapeless and have no size. Dots are an abstract idea. A point is depicted with a period, then given the name of the point. The name of a dot usually uses capital letters such as A, B, C.

A= Point A

B= Point B

C= Point C

2. Parallel Lines



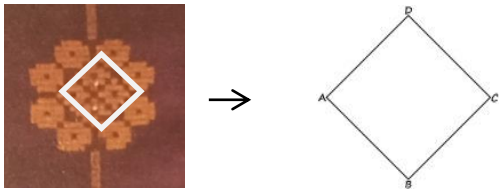
(a) (b)

Figure 16. (a) Mangosteen Motif, (b) Parallel Lines

An parallel line is a position of two lines on a flat plane that does not have a cut point even though the two lines are extended. The properties of parallel lines are:

1) Two lines that are parallel to each other have no intersection points.
2) Two parallel lines will be on the same plane.

3. Rhombus shape

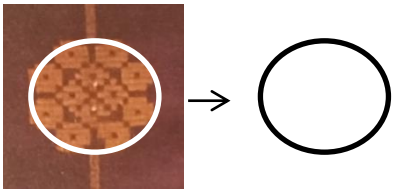


(a) (b)

Figure 17. (a) Mangosteen Motif, (b) Shape of Ribs

In this motif, small rhamlets are first formed, each diagonal is made into 4 threads, by repeating the same method so as to form the desired motif and if put together, the motif that is shaped is a large rhombus. A rhombus is one of the flat shapes composed of 4 sides of equal length and facing angles of equal size. All four sides are of equal length. Side AB = side BC = side CD = side DA, side AB is parallel to side CD, side BC is parallel to side DA. For angles that are equal to each other and divided by their diagonals into two equals, two equal lengths and perpendicular to each other.

4. Circle



(a) (b)

Figure 18. (a) Mangosteen Motif, (b) Circle Shape

In making motifs, by drawing on milli paper, by first forming the shape of small circles with the same distance and size, so as to form 8 small circles, if the motif is finished, then a circle is formed. A circle is a collection of points on a flat plane line that are all equally spaced from a given point. There are 8 elements in the circle, namely the center point, the radius, the diameter, the bowstring, the bow, the juring, the tembereng, and the apothema.

3) Motif Songket Siku Awan

Elbow Clouds Overlapping Cloud variations. Clouds that overlap each other so that they are depicted in the column motif on the side. After that, the motif is rotated 35 degrees so that the position becomes vertical. The motif is added to the reflection so that it becomes a pointed or geometric angular shape. The meaning of this motif is to help others so that what they want to achieve more easily.

Figure 19. Cloud Elbow Motif

In this motif there are shapes of number patterns and pointed angles.

1. Arithmetic number pattern

An arithmetic number pattern is an arrangement of numbers that has a fixed difference between the two terms.

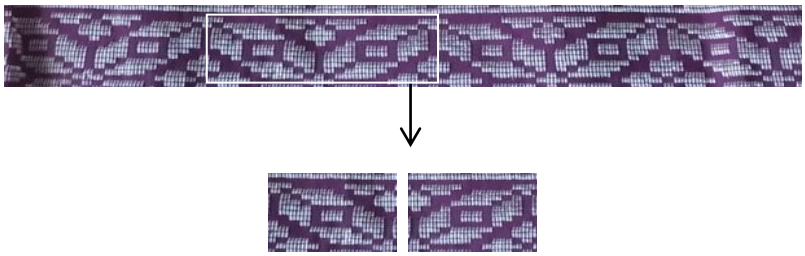


Figure 20. Left bevel and right bevel shape

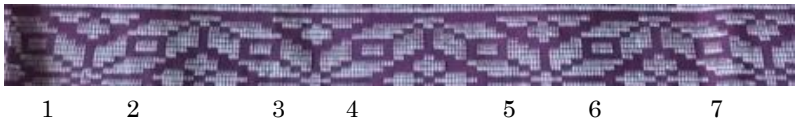
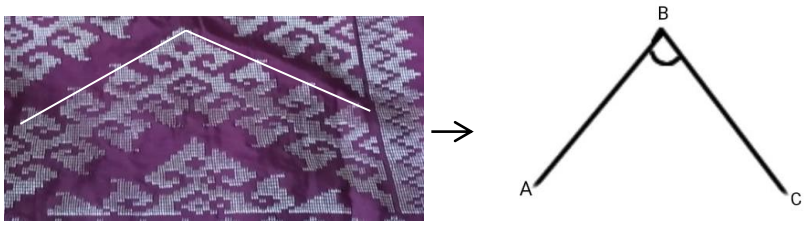


Figure 21. Arithmetic Number Pattern Shapes

Based on the **Figure 21**, the alternating hose motif which is oblique to the left has a pattern of 1,3,5,7. This means that each term of the pattern has a difference of 2 with the next term. Therefore, it can be known that the next term after 7 plus 2 is 9. If adjusted to the arithmetic sequence pattern with a difference of 2, then for the nth term the formula is obtained: $U_n = 2n - 1$. Furthermore, the alternating hose motif whose direction is oblique to the right has a pattern of 2,4,6. This means that each term of the pattern has a difference of 2 with the next term. Therefore, it can be known that the next term after 6 plus 2 is 8. If adjusted to the arithmetic sequence pattern with a difference of 2, then for the nth term the formula is obtained: $U_n = 2n$

a. Acute angle



(a) (b)

Figure 22. (a) Cloud Elbow Motif, (b) Sharp Angle Shape

A taper angle is an angle that has a magnitude less than $90°$ or rather the magnitude of the taper angle is between to less than. If denoted as x, it is the amount of angle measured.0°90°0° $< x < 90°$

2. Songket Siku Keluang Motif (Sticky Bee)

The songket elbow keluang motif has a meaning even though wherever we go, remember our own homeland, which is located on 2 parallel lines that are in each flower, because no matter how separated by distance (parallel lines), it will remain in the same row or remember the homeland (petal flowers that are in a straight row).

Figure 23. Keluang Elbow Motif

In this motif there are parallel lines and circles.

a. Parallel Lines

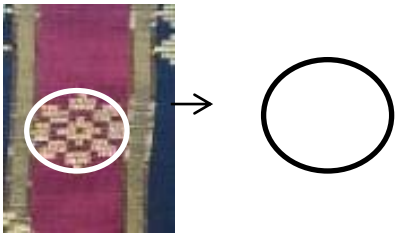
(a) (b)

Figure 24. (a) Motif Siku Keluang, (b) Parallel Line Shapes

An parallel line is a position of two lines on a flat plane that does not have a cut point even though the two lines are extended. The properties of parallel lines are:

a) Two lines that are parallel to each other have no intersection points.
b) Two parallel lines will be on the same plane.

b. Circle



(a) (b)

Figure 25. (a) Elbow Motif, (b) Circle Shape.

In making motifs, by drawing on paper milli, by forming flower petals with the same distance between petals, so that a sowing flower is formed that forms a circle. A circle is a collection of points on a flat plane line that are all equally spaced from a given point. There are 8 elements in the circle, namely the center point, the radius, the diameter, the bowstring, the bow, the juring, the tembereng, and the apothema.

4. CONCLUSION

Based on the results of this study, there are mathematical concepts in the typical Riau songket motif, namely the shape of a Triangle, Rib, Circle, Tube, Angle shape, Parallel lines, Dots, Reflections, Dilatations, and Number patterns. By using learning media in the form of culture, it can simplify the learning process and can also instill a sense of love for culture in Indonesia, one of which is in the Riau Songket woven fabric. Furthermore, for the readers, hopefully it can help find information and references contained in this research, and it is hoped that they can find new things and then improve them in the next research.

REFERENCES

Aini, I. N. (2018). Etnomatematika: Matematika dalam kehidupan petani di Kabupaten Karawang. *Teorema: Teori dan Riset Matematika*, *2*(2), 101-106.

Andini, P. (2023). Etnomatematika: Eksplorasi Konsep Geometri Pada Ornamen Rumah Bolon Batak Toba. *Jurnal pendidikan matematika Indonesia*, *6*(2), 100-104.

B. Matthew Miles dan Michael Huberman. (1992). Analisis Data Kualitatif Buku Sumber Tentang Metode-Metode Baru. Jakarta: UIP.

Creswell, John W. 2017. Pendekatan Metode Kualitatif, Kuantitatif dan Campuran. Yogya: Pustaka Pelajar.

Dekranasda Provinsi Riau. (2008). Khazanah Kerajinan Melayu Riau. Dekranasda bekerjasama dengan Balai Kajian dan Pengembangan Budaya Melayu Riau.

Randan, G. (2022). Eksplorasi Etnomatematika: Penggunaan Konsep Geometri Bangun Datar Pada Pola, Bentuk, Dan Motif Ukiran Toraja Di Tondon Matallo *(Doctoral Dissertation, Universitas Bosowa*).

Andriono, R. (2021). Analisis peran etnomatematika dalam pembelajaran matematika. ANARGYA: Jurnal Ilmiah Pendidikan Matematika, 4(2).

Mendoca, E. F., Disnawati, H., & Suddin, S. (2021). Eksplorasi Etnomatematika Pada Kain Tenun Masyarakat Desa Lamaksenulu. *Math-Edu: Jurnal Ilmu Pendidikan Matematika*, *6*(3), 123–131.

Mentari, & Rosandini, M. (2019). Pengembangan Motif Kain Tenun Songket Siak Khas Riau pada Produk Fesyen. *E-Proceeding of Art & Design*, *6*(3), 4216–4221.

Nursila, R., & Saputri, S. N. (2023). Eksplorasi etnomatematika materi geometri pada motif kain songket melayu pontianak. *Al-'Adad: Jurnal Tadris Matematika*, *2*, 41–50.

Rahmadani, T., & Reflina. (2023). Ethnomathematics Exploration of The Taganing. *8*(2), 589–602.

Rosa, M., & Orey, D. C. (2011). Ethnomathematics: the cultural aspects of mathematics Etnomatemática: os aspectos culturais da matemática.

Syahriannur. (2019). Eksplorasi Etnomatematika Kain Songket Minang Kabau Untuk Mengungkap Nilai Filosofi Konsep Matematika. *Jurnal MatchEducation Nusantara*, *2*(1), 58–63.

Zaenuri, N. D., & Suyitno, A. (2018). Pembelajaran Matematika Melalui Pendekatan Etnomatematika (Studi Kasus Pembelajaran Matematika di Chins).