ETHNOMATHEMATICS EXPLORATION OF THE MALAY TRADITIONAL HOUSE INDERA PERKASA PENYENGAT ISLAND, RIAU ISLANDS

EKSPLORASI ETNOMATEMATIKA RUMAH ADAT MELAYU INDERA PERKASA PULAU PENYENGAT, KEPULAUAN RIAU

[1,]Putri Annisa Alwahab, [2]Cindy Cancerlia, [3]Zikra Hani, [4]Putri Indah Lestari, [5*]Asmaul Husna
[1,2,3,5]Program Studi Pendidikan Matematika, Universitas Riau Kepulauan,
Kota Batam, Indonesia
[4]Program Studi Pendidikan Sejarah, Universitas Riau Kepulauan, Kota Batam,
Indonesia
[1]putriannisa280603@gmail.com, [2]cndycancerlia@gmail.com,
[1]zikrahaniprasetyo@gmail.com, [3]putriindahlestari2610@gmail.com,
[5]asmaul@fkip.unrika.ac.id.

*Corresponding author: asmaul@fkip.unrika.ac.id

Abstract

Mathematics learning is often considered a difficult and boring lesson so that many students do not understand the material provided by the teacher, so teachers are required to be more innovative, creative and varied in learning mathematics. One aspect that can be developed to make this learning more varied is by linking mathematics and culture which is called ethnomathematics. Indonesia is an archipelago that has a lot of cultural diversity. One of the cultural varieties originating from the Riau Islands is the Malay Archipelago Ornament. Nusantara Malay ornaments contain philosophy and life values that are very closely related to the Malay community of Riau Islands. This research was conducted to identify ethnomathematics contained in the Riau Islands Malay ornaments in the concept of mathematics, namely geometric transformation. The location where the research was conducted was the Indera Perkasa Malay Customary Hall located on Penyengat Island, Tanjung Pinang. The approach used is ethnography with qualitative research type. Data were obtained using observation and documentation techniques. The data analysis technique used is qualitative data analysis technique which consists of three steps, namely data reduction, data display, and conclusion drawing. The results showed that in the Malay ornament of Riau Islands there is a concept of geometry transformation, namely translation and reflection.

Keywords: Riau Archipelago Malay ornament, ethnomathematics, and transformation geometry.

Abstrak

Pembelajaran matematika seringkali dianggap sebagai pelajaran yang sulit dan membosankan sehingga banyak siswa yang kurang memahami materi yang diberikan oleh guru, sehingga guru dituntut untuk lebih inovatif, kreatif dan variatif dalam pembelajaran matematika. Salah satu aspek yang dapat dikembangkan agar pembelajaran ini lebih variatif adalah dengan mengaitkan matematika dan budaya yang sidebut dengan etnomatematika. Indonesia merupakan negara kepulauan yang memiliki banyak sekali keanekaragaman budaya. Salah satu ragam budaya yang berasal dari Kepulauan Riau adalah Ornamen Melayu Nusantara. Ragam hias Nusantara Melayu mengandung filosofi dan nilai-nilai kehidupan yang sangat lekat dengan masyarakat Melayu Kepulauan Riau. Penelitian ini dilakukan untuk mengidentifikasi etnomatematika yang terdapat pada ornamen Melayu Kepulauan Riau dalam konsep matematika yaitu transformasi geometri. Lokasi tempat dilakukannya penelitian adalah Balai Adat Melayu Indera Perkasa yang berada di Pulau Penyengat, Tanjung Pinang.

Pendekatan yang digunakan adalah etnografi dengan jenis penelitian kualitatif. Data diperoleh dengan menggunakan teknik observasi dan dokumentasi. Teknik analisis data yang digunakan adalah Teknik analisis data kualitatif yang terdiri dari tiga Langkah, yaitu reduksi data, display data, dan penarikan kesimpulan. Hasil penelitian menunjukkan bahwa pada ornamen Melayu Kepulauan Riau terdapat konsep geometri transformasi yaitu translasi dan refleksi..

Kata kunci: *ornamen melayu Kepulauan Riau, etnomatematika, dan geometri transformasi.*

INTRODUCTION

Mathematics learning is one of the important subjects learned by students at every level, it is also an obstacle that is often faced by students. This can also trigger students' disinterest in learning, often learning mathematics is considered a difficult and boring lesson so that many students do not understand the material provided by the teacher (Nisa et al., 2021). Whereas mathematics learning itself is a basic ability that includes problem solving, reasoning, communication, connection, and representation that needs to be developed by students (Kurnia Putri et al., 2019). Based on the results of the 2019 Program for International Student Assessment (PISA) study and exposure from Trends in International Mathematical and Scientific Research (TIMSS) that the quality of mathematics learning in Indonesia is still very low (Ariati & Juandi, 2022). According to (Maherah, 2020) the factors that determine the success of the world of education are also due to the role of teachers, the environment, local culture, and many other factors.

With this learning, teachers are required to be more innovative, creative and varied in learning mathematics. One aspect that can be developed to make this learning more varied is by connecting math and culture. Mathematics and culture are essential in everyday life, because culture is a whole and inclusive unit that can be applied to society. Meanwhile, mathematics is knowledge that is used to solve everyday problems (Hardiarti, 2017). Therefore, this merger is known as Ethnomathematics.

Mathematical practices in cultural groups such as a group of tribes, of a certain age group are also ethnomathematics (Putri, 2017). Culture is something that is inherent in everyday life for generations, because culture is a complete and comprehensive unit applied in a community, allowing mathematical concepts to be integrated into the environment of mathematical activities or practices. (Rachmawati, 2012). Ethnomathematics studies the efforts made by a person due to cultural differences whose purpose is to observe, pronounce, and apply concepts related to culture and mathematics. So that it raises the local wisdom of an area that can motivate students in learning mathematics.

In mathematics there are several branches of science, one of which is geometry. Geometry is a branch of science that begins to be studied from elementary school to college (Retni, 2016). Geometry is a mathematical science that studies points, lines, space and composition and volume that are abstract and interconnected. The reason why geometry is one of the important branches of mathematics to learn is because geometry can link math with the real world. And geometry can make it possible to visualize mathematical ideas (Safrina et al., 2014). Transformation geometry is a branch of geometry that studies changes in position or displacement from an initial position to another position. Transformation geometry has concepts namely transformation, reflection, translation, and rotation. learning mathematics that applies concepts related to culture can bring out the local wisdom of a region that can motivate students in learning mathematics (Wahyuni et al., 2014). math learning (Wahyuni et al., 2013)..

Indonesia itself has an abundant variety of cultures. The diversity of Indonesian culture found in several regions of the archipelago has a high aesthetic value, especially can be seen and measured from the level of art. Starting from building art, dance, handicrafts, carving, decorative arts and others (Dewita et al., 2019). One of them is in the Riau Islands Province, precisely in Tanjungpinang City, Penyengat Island. Penyengat Island is known as a historical place and has a variety of typical Malay ornaments which are often referred to as Malay motifs or ornaments which until now are often visited

by tourists both outside and within the country. One of them is a variety of typical Malay Riau Islands carving patterns that often decorate every typical Malay building (Nurhikmah et al., 2019). The pattern is usually found on the roof, dressing table and ventilation. Ornaments that are commonly used for decoration are geometric ornaments, along with the times it is rarely found. Therefore, to overcome the loss of existing culture due to the times. So the need for further study of culture accompanied by existing mathematics learning. With the hope that it can increase the love of local culture and become a new alternative for teachers to implement good and unique learning in accordance with the concept of mathematics learning.

One of the buildings that has a Malay style in the Riau Islands is the Indera Perkasa Customary Hall located on Penyengat Island, Tanjung Pinang, Riau Islands which functions as a place of activity to hold meetings and also carry out traditional Malay Riau ceremonies (Tyas et al., 2022). where the style is found on doors, windows, vents, roofs and several other parts. As for the ethnomathematics elements in the motifs in the Indera Perkasa Customary Hall, there is the concept of geometry (Rahman et al., 2022).

Indera Perkasa Traditional Hall is one of the historical relics of the Riau Islands which is now turned into a tourist attraction located on the Penyengat island. Indera Perkasa Malay Customary Hall is also used as a multi-purpose building by the local community. The building form of Indera Perkasa Malay Customary Hall is a type of traditional Malay building, namely Selaso Jatuh Kembar. The existence of this Customary Hall was originally known as a hall for the coronation of traditional leaders from the area (Fatimah et al., 2022).

The traditional house of selaso jatuh kembar at Indera Perkasa Malay Customary Hall has various ornaments that are not just for decoration. But for the Malay community, these ornaments contain various meanings and philosophies. Starting from the form of ornaments that are mostly sourced from nature such as plants, animals, geometric or combined motifs (Education & 2007, 2018).

Malay ornaments of Riau Islands are a result of the culture of ethnic tribes that still survive and have a strong relationship with existing traditions and customs. Ornaments not only have a relationship with culture, but also have a strong relationship with community activities. One of the Malay ornamental arts of the Riau Islands that we can easily find is carving. Each carving has a meaning and philosophy that describes the nature and attitude of the Riau Islands community.

So the purpose of this research is to explore the mathematical concepts contained in the Traditional Houses in Riau Islands Province, especially the Indera Perkasa Malay Traditional Hall. This research is also expected to foster a sense of love for local culture and be used as a new alternative and build a sense of innovation and creativity for teachers in implementing better, unique and concrete learning in utilizing existing culture in accordance with mathematical concepts.

METHODOLOGY

This research uses a qualitative method with an ethnographic approach. This method is used to analyze the decorative variety of Malay Riau Islands ornaments at the Indera Perkasa Malay Customary Hall located on Penyengat Island, Tanjung Pinang City. The ethnographic approach aims to obtain an in-depth description and analysis of culture (Bugin, B 2012). There are 2 techniques used, namely observation and documentation.

Observation in this study was carried out at the Indera Perkasa Malay Customary Hall of Penyengat Island by making direct observations of objects in the field with the aim of identifying the mathematical concepts contained in the ornaments of the Indera Perkasa Malay Customary Hall. Documentation collected in the form of photographs, sketches, and notes (Khofifah et al., 2018). The results of the documentation will be analyzed and observed and then associated with the appropriate mathematical concepts.

The data analysis used in this study used qualitative data analysis techniques according to (Miles et al., 2014). This technique consists of three steps, the first step is data reduction. At this stage, researchers summarize the data obtained in observation and documentation activities. The second step is data display. The last step is conclusion drawing. At this stage, researchers draw conclusions based on the results of data appearance in accordance with the research objectives.

RESULTS AND DISCUSSION

Based on the data collected, there are 11 ornament motifs found at Indera Perkasa Customary Hall. The ornament motifs will be shown in Table 1.

Table 1. Ornamental motifs of Indera Perkasa Customary Hall

No.	Original Image	Carving Name	Types of Ornaments
1.		Awan Larat	Symmetrical
2.		Bunga Kundur	Symmetrical
3.		Kaluk Pakis	Symmetrical
4.		Kaluk Pakis	Symmetrical
5.		Lebah Bergantung	Symmetrical
6.		Rantai Berakit	Symmetrical
7.		Bunga Kundur	Symmetrical
8.		Lebah Bergantung	Symmetrical

No.	Original Image	Carving Name	Types of Ornaments
9.		Bantal Gadok	Symmetrical
10.		Bunga Kundur	Symmetrical
11.		Bidai	Symmetrical

Based on table 1, the 11 ornaments explored at Indera Perkasa Malay Customary Hall are all symmetrical. A flat shape is said to be symmetrical if it can cover each other when folded or rotated. The symmetry used in this research is plane symmetry. This concept can also be called isometric or transformation geometry. There are 4 types of transformation geometry, namely translation (shift), rotation (rotation), reflection (mirroring), dilation (multiplication) (Astriandini & Kristanto, 2021). The following is an explanation of the identification of the relationship between the ornamental motifs found in the Indera Perkasa Malay Customary Hall of Penyengat Island with the concept of transformation geometry.

A. Translation (Shifting)

Translation is the process of changing position on a flat plane, but the shape and size of the plane does not change. The concept of translation is found in the Lebah Bergantung motif as found in Figure 1.

Figure 1.lebah bergantung motif (Titof 2018)

In Figure 1, Lebah Bergantung motif has undergone a translational process. This Hanging Bee motif can be found in several parts of the meeting hall such as the front of the roof and the aisle cloth.

The dependent bee motif has a philosophical value that can be explained by the expression "The bee hangs on the roof drop. In front of the honey fence. Behind the sweet fence. The sweetness of pouring into the inner room. The sweetness of feeling. The sweetness of sucking" (Ihsan & Utami, 2022). In the sense that the attitude of self-sacrifice and selflessness is lifted from the nature of bees that give their honey for the benefit of others (Titof, 2018).

B. Reflection (Mirroring)

Reflection or mirroring means change by moving a point in the nature of mirroring. (Yahya & Haeiruddin, 2023). There are two properties that mirroring has. The first is that the distance from the point to the mirror is proportional to the distance of the shadow of the point to the mirror. The second is that the mirrored objects face each other. The concept of Reflection is found in Bidai motif, Larat Cloud motif, and Kaluk Pakis motif in Figure 2.

Figure 2.Bidai motif, Awan Larat motif, Kaluk Pakis motif (Hadiawan)

The Bidai motif is usually made multilevel and decorated, while functioning as ventilation. The part that juts out which is given a floor is called teban layar or alang buang floor or also undan - undan. The shape of the bidai motif above looks symmetrical. So that the bidai motif contains the concept of reflection (mirroring). This Bidai motif is found on the roof of the Customary Hall. Bidai is also known as "teban layar" or tebek.

This awan larat Motif also has a symmetrical concept, namely reflection. As seen in Figure 2 with the blue line as a symmetrical axis. The awan larat batik motif in the picture above has a philosophy that means the softness of local wisdom culture whose elongated decoration symbolizes that the fortune is smooth so that it gives joy. The Larat Cloud motif is often associated by the community with gentleness, wisdom, and self-knowledge. These characteristics are moral messages that have been passed down by the ancestors of the local community. This motif is inspired by nature, namely clouds that move when blown by the wind (Sasya, Menul Teguh Riyanti, 2017).

The Kaluk Pakis Motif also has a symmetrical concept, namely reflection. As seen in Figure 2 with the black line as a symmetrical axis. Kaluk Pakis is an ornamental motif whose shape is a plant. This motif means fertility and prosperity (Irwansyah, Heldiansyah 2021). For the Malay people of the Riau Islands, this motif symbolizes life which ultimately returns to God Almighty. (Prihatin, 2007).

The ethnomathematical concept of transformation geometry reflected in traditional ornaments, such as translation and reflection in Malay Riau Islands ornaments, opens the door to interesting alternatives in mathematics learning. These ornaments are not just a visual decoration, but also a rich mathematical representation, showing the principles of transformation geometry in a concrete way. They offer a golden opportunity to introduce mathematical concepts in a real context and stimulate students' interest in the subject.

In the context of mathematics learning, Malay Riau Islands ornaments can be a valuable resource. The use of ornaments as learning media brings the concept of transformation geometry into the classroom in a more interesting and tangible way. Through the exploration of ornaments, students can learn how translation and reflection are applied in the formation of beautiful and culturally meaningful ornaments (Ambarwati et al., 2023). This not only improves students' understanding of mathematical concepts, but also opens their minds to the presence of mathematics in everyday art and culture.

Malay ornaments of Riau Islands can be used as a concrete example in illustrating the application of transformation geometry. Students can see and understand how each element of the ornament changes through transformation, giving them a deeper understanding of the underlying mathematical concepts. Thus, the use of these ornaments as learning media can motivate students to participate more and explore the potential of mathematics in a cultural context.

The importance of integrating ethnomathematical concepts of transformational geometry, as depicted in Malay Riau Islands ornaments, in mathematics learning is not just about understanding theories and formulas. It also provides students with hands-on experience with the application of mathematics in their daily lives, enriching their perspective towards mathematics as a cultural element. In this way, mathematics education does not only become formal learning in the classroom, but also a window to understand and appreciate the cultural richness inherent in mathematical concepts.

CONCLUSIONS

The Malay ornamental motifs found at the Indera Perkasa Malay Customary Hall provide a rich illustration of the concept of transformation geometry, especially involving translations and reflections. The beauty and complexity of these ornaments provide a potential basis for integration into mathematics learning in schools. By utilizing ornaments as learning media, students can be directly involved in understanding the concepts of transformation geometry in a contextual manner, opening their horizons to the application of mathematics in local culture.

As a suggestion, the results of this study can be applied in designing mathematics curriculum at the secondary school level, by integrating elements of transformation geometry inspired by Malay ornaments. Lessons that focus on the application of mathematics in local culture can motivate students to be more active and participate in learning, while improving their understanding of mathematical concepts underlying cultural wealth. In addition, the development of learning modules or exploration activities that link mathematics with local culture can be an alternative approach that is more fun and meaningful for students. Thus, the integration of transformational geometry concepts from Malay ornaments becomes an innovative means of opening the door to students' insights into the beauty of mathematics inherent in their own cultural context.

ACKNOWLEDGMENTS

REFERENCES

Ambarwati, B., Zulkardi, Z., & Susanti, E. (2023). Students' reflective thinking skills in solving PMRI problems in the context of South Sumatra's identity ornaments. Delta-Pi: Journal of Mathematics and Mathematics Education, 12(1), 25-37. https://doi.org/10.33387/dpi.v12i1.5455

Ariati, C., & Juandi, D. (2022). Mathematical Reasoning Ability: A Systematic Literature Review. Lemma Journal, 8(2), 61-75. https://doi.org/10.22202/jl.2022.v8i2.5745

Fatimah, A., Wulandari, M., & Alexander Alim, J. (2022). Exploration of Ethnomathematics in the Building of Riau Traditional House Selaso Jatuh Kembar. Science and Education Journal (SICEDU), 1(2), 403-413. https://doi.org/10.31004/sicedu.v1i2.58

Hardiarti, S. (2017). Ethnomathematics: Application of Quadrilateral Flat Buildings in Muaro Jambi Temple. Aksioma, 8(2), 99. https://doi.org/10.26877/aks.v8i2.1707

Ihsan, R., & Utami, W. S. (2022). Plant and Maritime Batik Motifs as Ethnic Identity of Malay Batam Riau Islands. Gorga: Journal of Fine Arts, 11(2), 417. https://doi.org/10.24114/gr.v11i2.38650

Irwansyah, Heldiansyah (2021). Application of Deli Malay Ornament in the Interior Design of Pasujudan Jannatun Naim Mosque. Journal of Design, Multimedia, and Creative Industries Proportion, 6(2), 103-113. https://e-journal.potensi-utama.ac.id/ojs/index.php/PROPORSI/article/view/1309/1769

Khofifah, L., Sugiarti, T., & Setiawan, T. B. (2018). Ethnomathematics of Batik Artwork Typical of Osing Banyuwangi Tribe as Student Worksheet Material for Transformation Geometry. Kadikma, 9(3), 148-159. https://jurnal.unej.ac.id/index.php/kadikma/article/view/11066/6702

Khusnul Safrina, M. Ikhsan, & Anizar Ahmad (2014). Improving Geometry Problem Solving Ability through Cooperative Learning Based on Van Hiele Theory. Journal of Mathematics Didactics, 1(1), 1-20. https://jurnal.usk.ac.id/DM/article/view/1333

Kurnia Putri, D., Sulianto, J., & Azizah, M. (2019). Mathematical Reasoning Ability in View of Problem Solving Ability. International Journal of Elementary Education, 3(3), 351. https://doi.org/10.23887/ijee.v3i3.19497

Maherah, R. (2020). The Role of Islamic Religious Education Teachers in Shaping Religious Attitudes in Students A . Introduction Allah SWT has given demands to humans by sticking to His religion, namely Islam. Islam provides various instructions about life. Journal of At-Ta'lim, 19(1), 209-232. https://doi.org/10.29300/atmipi.v19.i1.2433

Miles, M. B., Huberman, A. M., & Saldana, J. (2014). Qualitative Data Analysis: A Methods Sourcebook (3rd ed.). SAGE Publications : Los Angeles, London, New Delhi, Singapore, Washington DC. 408 pages.

Nisa, A., MZ, Z. A., & Vebrianto, R. (2021). Problematics of Mathematics Learning at SD Muhammadiyah Kampa Full Day School. El-Ibtidaiy: Journal of Primary Education, 4(1), 95. https://doi.org/10.24014/ejpe.v4i1.11655

Nurhikmah, S., Fera, M., & Maritim Raja Ali Haji, U. (2019). Exploration of Ethnomathematics in the Variety of Typical Malay Carving Patterns of Riau Islands. Journal of Kiprah, 7(1), 41-48. https://doi.org/10.31629/KIPRAH.V7I1.1313

Purwo Prihatin (2007). Ornamental Art in the Context of Riau Malay Culture. Journal of Arrts Research you Education, 8(3), 1-10. https://journal.unnes.ac.id/nju/index.php/harmonia/article/view/778

Putri, L. (2017). Exploration of Ethnomathematics of Tambourine Art as a Mathematics Learning Resource at the Mi Level. UNISSULA Scientific Journal of Basic Education, 4(1), 136837.

Rahman, S. A., Elsa, E., Fatimah, L., Hasanah, R. S., & Kosasih, U. (2022). Ethnomathematics: Exploration of Geometry Concepts. Journal of Authentic Research on Mathematics Education (JARME), 4(2), 217-233.

Retni Paradesa (2016). Development of Visual Based Transformation Geometry Teaching Materials. Journal of Mathematics Education JPM RAFA, 2(1), 56-84 .https://jurnal.radenfatah.ac.id/index.php/jpmrafa/article/view/1241/1034,

Sasya, L., Menul, T. R. (2017). Study of Traditional Siak Malay Songket Weaving Motifs Typical of Riau. Journal of DKV Dimensions of Art and Design, 2(1), 33-48. https://e-journal.trisakti.ac.id/index.php/seni/article/view/1876

Tyas, A. K., Ursia, A. A., & Carolina, O. P. (2022). Ethnomathematics Study on the Building Structure of Riau Traditional House Selaso Jatuh Kembar. PRISMA, Proceedings of the National Seminar on Mathematics, 5, 397-405. https://journal.unnes.ac.id/sju/index.php/prisma/

Wahyuni, A., Tias, A. A. W., & Sani, B. (2013). 18454275. Proceedings of the National Seminar on Mathematics and Mathematics Education FMIPA UNY, 1(1), 113-118.

Yahya, M. H. N., & Haeiruddin. (2023). Exploration of Ethnomathematics in the House Carving of Lamin Adat Pamung Tawai Cultural Village Pampang through the Concept of Geometric Transformation. National Seminar on Mathematics Education, Mulawarman University, 3, 183-191. https://jurnal.fkip.unmul.ac.id/index.php/psnpm.