International Seminar on Student Research in Education, Science, and Technology
ISSN 3047-1532| Volume 2 April 2025, pp. 471-477
https://www.issrestec.id/
http://journal.ummat.ac.id/index.php/issrestec
Universitas Muhammadiyah Mataram, Indonesia

Ethnomathematics in the VOC Coins: Geometric Patterns in the VOC Coins and Implications in Mathematics Learning

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Abstract: Ethnomathematics in the field of mathematics has the meaning of a new study that has the potential to be developed into the latest learning innovation that contains a combination of contextual learning and at the same time introduces the culture in Indonesia to students. This research explores the ethnomathematics contained in the coins of the Vereenigde Oost-Indische Compagnie (VOC) from the 17th to the 18th centuries. The primary focus is identifying and analyzing the geometric patterns in the coin's design, including the basic shape, ornamental motifs, and overall composition. The research method used is qualitative descriptive analysis with an ethnomathematical approach, which examines the relationship between mathematics and culture. The study results show that VOC coins contain various geometric concepts such as circles, and geometric transformations. These findings imply the development of culturally based mathematics learning materials, specifically using VOC coins as a real context. Using these historical artifacts is expected to increase students' understanding of geometric concepts and foster appreciation for cultural heritage. This research also contributes to developing ethnomathematics as an innovative and relevant learning approach.

Keywords: VOC Coin, Geometric Patterns, Mathematics Learning.

Article History:
Received: 01-04-2025
Online : 28-04-2025

A. INTRODUCTION

According to Law number 20 of 2003 concerning the national education system, education is a conscious effort to create a learning atmosphere and learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble morals, and skills required from them, society, nation and state. Mathematics is one field of study at all levels of education from elementary school to college (La'ia & Harefa, 2021). One must understand abstract ideas in mathematics to apply them correctly and adequately. One of the purposes of this mathematics subject is to equip students with a set of knowledge and understanding of concepts in the field of mathematics which can then be applied in solving problems in real daily life. A clear presentation of math lessons must be emphasized to understand concepts easily and interestingly (Purba, 2022).

Mathematics is a science field that studies systematically structured knowledge, including understanding quantities, spaces, and changes. The origin of the word 'mathematics' itself, namely 'mathematikos', hints at its nature that requires perseverance and deep study in the learning process. In other words, mathematics is a science built through logical reasoning, which requires an effort to activate reason and ratio. Thus, the essence of mathematics lies in the human ability to connect basic ideas, methods, and logic through the process of thinking. The mathematical skills learned by students in school are not logically constructed and based on abstract cognitive structures, but rather as a

combination of previously acquired knowledge and skills as well as as a new input (culture) where activities involving numbers, geometric patterns, counts and so on are considered as applications of mathematical knowledge. Which is better known as ethnomathematics.

Ethnomathematics has become a trend in the field of cultural education, besides that ethnomathematics also preserves the existence of cultural values in the future. Ethnomathematics is mathematics in a culture. The culture in question is the habits of human behavior in their environment, such as the behavior of urban or rural community groups, work groups, professional classes, students in age groups, indigenous peoples, and certain other groups (Sarwoedi et al., 2018) Ethnomathematics is the study in mathematics learning that connects mathematics with the culture in the environment in which individuals live. The use of ethnomathematics is an encouragement for students in mathematics learning and learning is more meaningful because students are directly involved in learning whose use is in daily life (Izah & Malasari, 2021). Meanwhile, according to (Muhammad, 2023) Ethnomathematics is one of the very promising approaches in helping students explore their culture to get ideas from mathematical concepts. Ethnomathematics is closely related to the mathematical way of thinking of a society related to its culture, and can be integrated into the school curriculum. Ethnomathematics is the study of specific patterns or distinctive colors of mathematics that live and develop in society. So, ethnomathematics is an approach that involves local culture with mathematical concepts that can be incorporated into the learning process in schools.

According to Nuryadi et al. (2020), ethnomathematics is essential in bridging the preservation of local culture and wisdom with technological advances through science. Putra & Mahmudah (2021) also emphasized that ethnomathematics-based learning is crucial to science development, especially for students. In addition, Marchy et al. (2022) affirm that ethnomathematics is equally vital in mathematics learning. Sudihartinih (2020) supports this view by stating that ethnomathematics is crucial in mathematics learning. Widada et al. (2018) added that mathematics learning using ethnomathematics allows the abstraction, idealization, and generalization of mathematical concepts. Finally, Manoy & Purbaningrum (2021) concluded that ethnomathematics is a practical choice for mathematics teachers to connect local cultures, making mathematics learning more relevant in the context of students' cultures.

One of the cultural artifacts that holds mathematical riches is the coins of the Vereenigde Oost-Indische Compagnie (VOC). These coins, which were widely circulated in the archipelago during the colonial period, not only have historical and economic value, but also contain interesting geometric patterns. These patterns, such as circles, faces, and decorative motifs, reflect the mathematical understanding of the society of the time. In the context of mathematics education in Indonesia, VOC coins can be an effective tool to improve students' understanding of geometry concepts. Examining the geometric patterns on VOC coins allows students to see how mathematics is applied in a real context and relevant to their history. This can make learning mathematics more meaningful and engaging for students. In addition, the use of VOC coins in mathematics learning can also help students develop critical and analytical thinking skills. Students can be invited to observe, analyze, and

interpret geometric patterns on VOC coins and relate them to relevant mathematical concepts. This process can help students build a deeper understanding of mathematics and how mathematics connects to the world around them

One of the mathematics learning closely related to culture and ethnomathematics is geometry material. Learning combined with culture can add enthusiasm to mathematics learning because learning usually in the classroom can now explore the arts and culture in the surrounding environment. The existence of ethnomathematics in the field of geometry is also a plus point because in addition to learning mathematics, students can also get to know the local culture. Geometry is a branch of mathematics that is taught at every level of education, both at the elementary school education level to college. Geometry is a part of mathematics that is very close to students, because almost all visual objects around students are geometric objects Understanding the correct and precise concept of geometry can help a person present and describe the surrounding world in an orderly order. Your child's experience of the surrounding world, objects, and other people will provide the cognitive foundations for further geometry learning. Geometry material in elementary school must consider the child's experience so that there is no leap from the child's perspective on the world around the child before with new experiences (Andriliani et al., 2022).

Using ethnomathematics in mathematics learning, especially geometry, is expected to optimize students' learning abilities. This is because students are given questions or problems relevant to their daily culture, such as arithmetic. collecting, processing, and interpreting data, Through ethnomathematics-based learning, students will be more interested in learning. The understanding gained by students is not only limited to mathematical concepts, but also an understanding of culture in their lives (Hartanti & Ramlah, 2021). Based on the above problems, the researcher is interested in analyzing Ethnomathematics in VOC Coins: Geometric Patterns in VOC Coins and Implications in Mathematics Learning

B. METHOD

This study uses a qualitative descriptive approach. This approach was chosen because it aims to deeply understand a phenomenon happening at this time, whether it is related to society, objects, or thought conditions. The main goal of the qualitative descriptive method is to provide a clear, systematic, and accurate picture based on the existing facts. This is done to investigate the relationship between phenomena and their characteristics. The Safrudin (2023) argues that identifying a descriptive research is a way that aims to draw clear and broad conclusions. The location of this research was conducted at the Banten museum located on Jl. Brigadier General K.H. Syamun, Kotabaru, Serang-Banten Square.

C. RESULT AND DISCUSSIONS

The research results the researcher has carried out are identifying geometric patterns found in VOC coins, such as circles, circle segments, and decorative patterns that contain symmetrical elements. In addition, different pattern variations were found on VOC coins from different periods and issuing regions. An in-depth analysis of the dimensions and

proportions of the coin also shows the application of mathematical concepts in the process of making it.

Figure 1. VOC Coin

Based on the image above, the researcher revealed that the design of the VOC coin reflects an understanding of geometric concepts, such as the area of the circle, circumference, and symmetry. The process of coin-making, which includes measurement and printing, also involves the application of practical mathematical skills. In addition, the decorative patterns on the coins show an understanding of repetition and fractals. VOC coins, like coins in general, have a circular shape. In geometry, a circle is a flat shape with a fixed distance from the central point to all points around it, which is called a radius. Mathematically, the formula for the circumference and area of the circle is:

1. **Circumference** = 2 π r2 where r is the radius of the circle.
2. **Speed** = π r2

Figure 2. VOC Coin

As shown above, the circular VOC coin has a diameter and radius that can be calculated using the formula above. The following is a circle math problem using the VOC coin media (Vereenigde Oostindische Compagnie) Question: An ancient VOC coin has a diameter of 2.8 cm. Count the circumference of the coin. Calculating the circumference of a coin: Coin diameter (d)= 2.8 cm; Formula circumference of a circle (K) = πd.

K = w x 2.8 cm
K = 3.14159 x 2.8 cm
K = 8,796 cm

So, the circumference of the VOC coin is about 8,796 cm. Calculating the surface area of a coin: Finger – finger of a coin (r) = = = 1.4 cm$\frac{d}{2}\frac{2{,}8\ cm}{2}$; Formula of circle area (L) = π r^2

$$L = \pi \times (1{,}4\ CM)^2$$
$$L = w \times 1.96\ cm^2$$
$$L = 3.14159 \times \quad 1.96\ cm^2$$
$$L = 6.158\ cm^2$$

So, the surface area of one side of the VOC coin is about 6,158 cm^2. The above question shows that VOC Coins can be used as a contextual and engaging mathematics learning medium for students. Its use can help students understand geometric concepts visually and practically. The ethnomathematical approach using VOC coins can also increase students' interest and motivation in learning mathematics. In addition, the use of VOC coins in learning also introduces students to history and culture, making it more meaningful and engaging.

D. CONCLUSION AND SUGGESTIONS

This research shows that VOV coins in the era of the Sultanate of Banten not only have historical and cultural value, but also contain relevant mathematical concepts, especially geometry (circles). The people of Banten in the past, intuitively applied mathematical principles in VOC coins. The mathematical model used in the study, namely. Circumference = 2 π r2 where r is the radius of the circle; and Speed = π r2. VOC coins can be analyzed logically and systematically with modern mathematical approaches.

The ethnomathematical approach using VOC coins can also increase students' interest and motivation in learning mathematics. In addition, the use of VOC coins in learning also introduces students to history and culture, making it more meaningful and engaging. Ethnomathematical approaches using VOC coins can bridge the gap between formal and informal mathematics in people's cultures. Using contextual and culturally-specific learning media, such as VOC coins, can potentially improve students' understanding of the relevance of mathematics in everyday life. In addition, this research also emphasizes the importance of integrating historical and cultural elements in mathematics learning, so that learning becomes more interesting and meaningful. These findings strengthen ethnomathematics's position as a bridge between cultural heritage and contextual mathematics learning. Ethnomathematics not only uncovers how mathematics lives in local cultures, but also becomes a practical approach to foster students' interest in learning through cultural values close to everyday life.

ACKNOWLEDGEMENT

The author would like to express his deepest gratitude to all parties who have supported the preparation of this research. Thank you also to the supervisor who has provided direction, input and guidance during the research process, and thank you to the Old Banten Archaeological Site Museum for providing permits and valuable information related to

Banten Coins data as our research material. The author realizes that this research is still far from perfect. Therefore, constructive criticism and suggestions are highly expected for the author for future refinement.

REFERENCES

Andriliani, L., Amaliyah, A., Putry Prikustini, V., & Daffah, V. (2022). Analisis Pembelajaran Matematika Pada Materi Geometri. *SIBATIK JOURNAL: Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, Dan Pendidikan*, *1*(7), 1169–1178. https://doi.org/10.54443/sibatik.v1i7.138

Hartanti, S., & Ramlah, R. (2021). Etnomatematika: Melestarikan Kesenian dengan Pembelajaraan Matematika. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *7*(2), 33. https://doi.org/10.32884/ideas.v7i2.347

Izah, S. J., & Malasari, P. N. (2021). Studi Etnomatematika: Masjid Sunan Bonang dalam Pembelajaran Geometri. *CIRCLE : Jurnal Pendidikan Matematika*, *1*(01), 44–58. https://doi.org/10.28918/circle.v1i1.3597

La'ia, H. T., & Harefa, D. (2021). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematik Siswa. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *7*(2), 463. https://doi.org/10.37905/aksara.7.2.463-474.2021

Muhammad, I. (2023). Penelitian Etnomatematika Dalam Pembelajaran Matematika (1995-2023). *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *4*(1), 427–438. https://doi.org/10.62775/edukasia.v4i1.276

Purba, G. F. (2022). Implementasi Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) Pada konsep Merdeka Belajar. *Sepren*, *4*(01), 23–33. https://doi.org/10.36655/sepren.v4i01.732

Safrudin, R., Zulfamanna, Kustati, M., & Sepriyanti, N. (2023). Penelitian Kualitatif. *Journal Of Social Science Research*, *3*(2), 1–15.

Sarwoedi, Marinka, D. O., Febriani, P., & Wirne, I. N. (2018). Efektifitas etnomatematika dalam meningkatkan kemampuan pemahaman matematika siswa. *Jurnal Pendidikan Matematika Raflesia*, *03*(02), 171–176.

Andriliani, L., Amaliyah, A., Putry Prikustini, V., & Daffah, V. (2022). Analisis Pembelajaran Matematika Pada Materi Geometri. *SIBATIK JOURNAL: Jurnal Ilmiah Bidang Sosial, Ekonomi, Budaya, Teknologi, Dan Pendidikan*, *1*(7), 1169–1178. https://doi.org/10.54443/sibatik.v1i7.138

Hartanti, S., & Ramlah, R. (2021). Etnomatematika: Melestarikan Kesenian dengan Pembelajaraan Matematika. *Ideas: Jurnal Pendidikan, Sosial, Dan Budaya*, *7*(2), 33. https://doi.org/10.32884/ideas.v7i2.347

Izah, S. J., & Malasari, P. N. (2021). Studi Etnomatematika: Masjid Sunan Bonang dalam Pembelajaran Geometri. *CIRCLE : Jurnal Pendidikan Matematika*, *1*(01), 44–58. https://doi.org/10.28918/circle.v1i1.3597

La'ia, H. T., & Harefa, D. (2021). Hubungan Kemampuan Pemecahan Masalah Matematis dengan Kemampuan Komunikasi Matematik Siswa. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *7*(2), 463. https://doi.org/10.37905/aksara.7.2.463-474.2021

Muhammad, I. (2023). Penelitian Etnomatematika Dalam Pembelajaran Matematika (1995-2023). *EDUKASIA: Jurnal Pendidikan Dan Pembelajaran*, *4*(1), 427–438. https://doi.org/10.62775/edukasia.v4i1.276

Purba, G. F. (2022). Implementasi Pendekatan Pendidikan Matematika Realistik Indonesia (PMRI) Pada konsep Merdeka Belajar. *Sepren*, *4*(01), 23–33. https://doi.org/10.36655/sepren.v4i01.732

Safrudin, R., Zulfamanna, Kustati, M., & Sepriyanti, N. (2023). Penelitian Kualitatif. *Journal Of Social Science Research*, *3*(2), 1–15.

Sarwoedi, Marinka, D. O., Febriani, P., & Wirne, I. N. (2018). Efektifitas etnomatematika dalam meningkatkan kemampuan pemahaman matematika siswa. *Jurnal Pendidikan Matematika Raflesia*, *03*(02), 171–176.