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Exploration of Ethnomathematics in Kidal Temple Ornaments For Geometry Learning

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Abstrak

Pembelajaran yang mengaitkan materi dengan konteks kehidupan siswa dan budayanya akan memudahkan siswa dalam memaknai pembelajaran. Salah satu ilmu yang dapat menghubungkan antara pendidikan dan budaya yaitu etnomatematika. Pendidikan penting dalam proses pewarisan budaya dan budaya penting untuk diimplementasikan dalam pembelajaran. Budaya peninggalan Kerajaan Singosari yaitu berupa artefak dan juga aktivitas manusianya. Pengaruh budaya lokal mengadaptasi candi sehingga desain, candi di Indonesia bervariasi. Penelitian ini bertujuan menggali dan mendeskripsikan konsep geometri yang diaplikasikan dan dikembangkan pada ornamen hiasan pada Candi Kidal. Jenis penelitian yang digunakan yaitu penelitian kualitatif dengan pendekatan etnografi. Pengambilan data dilakukan dengan melakukan wawancara, observasi, dan dokumentasi. Teknik analisis data yang digunakan yaitu analisis domain dan analisi taksonomi. Hasil penelian menunjukkan adanya konsep matematika geometri yang diterapkan pada arsitektur bangunan Candi Kidal. Ornamen yang menghiasi Candi Kidal mengimplemenasikan konsep matematika. Konsep matematika dalam ornamen tersebut merepresentasikan konsep bangun datar dalam materi geometri. Konsep bangun datar segiempat dan lingkaran ditemukan dalam ornamen medallion. Konsep geometri bangun datar segitiga ditemukan dalam ornamen tumpal pada atap candi, selanjutnya dalam ornamen sulur atau flora yang terdapat pada kaki candi menerapkan konsep refleksi atau pencerminan terhadap sumbu x.

Abstract

Learning that relates material to the context of students' lives and culture will make it easier for students to interpret learning. One of the sciences that can connect education and culture is ethnomathematics. Education is important in the process of cultural inheritance and culture is important to be implemented in learning. The cultural heritage of Singosari Kingdom is in the form of artifacts and also human activities. The influence of local culture adapts the temple, so the design of temples in Indonesia varies. This research aims to explore and describe the concept of geometry that is applied and developed in the decorative ornaments of Kidal Temple. The type of research used is qualitative research with an ethnographic approach. Data will be collected through interviews, observation and documentation. The data analysis techniques used are domain analysis and taxonomy analysis. The results showed the existence of the concept of mathematical geometry applied to the architecture of the Kidal Temple building. The ornaments that decorate Kidal Temple implement mathematical concepts. The mathematical concept in the ornament represents the concept of flat shapes in the geometric material. The concept of rectangular and circular flat shapes is found in the medallion ornaments. The concept of triangular flat geometry is found in the tumpal ornament on the roof of the temple, then in the sulur or floral ornament found at the foot of the temple, the concept of reflection or mirroring of the x-axis is applied.

INTRODUCTION

Mathematics and culture are two things that cannot be avoided in everyday life and are related to each other. Mathematics and culture grow together in a community environment, so a person's mathematical knowledge is influenced by his or her cultural background. Mathematics is a form of culture that is integrated into people's lives (Wayan et al., 2023).This can be interpreted that different mathematical concepts can be found in culture, so it can be clarified that mathematics and culture are interrelated.

Indonesia has a variety of cultures, so the application of mathematics in each culture also varies. For example, the Malay people in Riau have a special number system in the construction of residential houses, which reflects some of the philosophy of house construction (Nuh & Dardiri, 2016). Furthermore, the Madurese traditional houses in Taneyan Lanjang settlement

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are characterized by houses lined up from west to east with long rectangular courtyards and have Madurese carvings (Kurnia & Nugroho, 2015). Then, the traditional Toraja house called Tongkonan has unique and beautiful carvings that inadvertently show the use of mathematical ideas and concepts such as the concept of geometry in the culture and life of the Toraja people (Tandililing, 2015). These three examples are enough to explain that a person's mathematical knowledge grows with the culture in a community environment.

Based on this, it is important to further explore how the relationship between culture and mathematics can be utilized in learning. The bridge between culture and mathematics is an important step to find out how thinking can shape different forms of mathematics and make it easier for students to understand mathematics (Zaenuri & Dwidayati, 2018). Mathematics in culture can be used as a concrete resource for learning mathematics. Culture, mathematics, and education can be combined and obtained through a study that examines the particular ways in which certain cultural groups understand and apply mathematical concepts and practices, called ethnomathematics.

Ethnomathematics was first introduced in 1977 by D'Ambrosio, a Brazilian mathematician. Ethnomathematics can be defined as the way people from certain cultures use mathematical ideas and concepts (Marinka et al., 2018). Ethnomathematics objects are cultural objects that have mathematical concepts in a society. Ethnomathematics objects can be in the form of traditional games, traditional crafts, artifacts, and activities (activities) in the form of culture (Hardiarti, 2017)..

One of the cultural heritage objects in East Java where mathematical concepts can be found is the temple. When viewed from a mathematical perspective, there are several ideas and concepts in temples in Indonesia. Kidal Temple, is one of the cultural heritage temples of Singasari Kingdom. This temple was built as a form of respect for the great services of Anusapati, the second king of Singhasari who ruled for 20 years (1227 - 1248) According to Pararaton, Anusapati's death was killed by Panji Tohjaya as part of the Singhasari power struggle, also believed to be part of Mpu Gandring's curse. Kidal Temple is architecturally thick with East Javanese culture, having undergone restoration in 1990. Kidal Temple also contains the story of Garudeya, a Hindu mythological story that contains a moral message of liberation from slavery. To date, the temple is still maintained and well preserved (Rahmawati et al., 2020).

Kidal Temple is derived from the name of the village and is located in the center of the temple grounds. Kidal Temple is Hindu, formerly in the temple room (garbhagrha) was a place for the statue of Shiva Mahadeva, which is currently stored at the Royal Tropical Institute in Amsterdam. It consists of statues of the second king of the Singhasari kingdom and king Anuspati. The temple is located in a valley on the western slope of Tengger Mountain at an altitude of 520 meters above sea level, including the administrative area of Kidal Village, Tumpang District, about 20 km east of Malang Regency - East Java.

Kidal Temple was built in 1248 AD to coincide with the end of a series of ceremonies called Sradha (12th year after death) to honor the late King Anusapati. After restoration in the 1990s, the temple now stands tall and strong, revealing its beauty. The road leading to Kidal Temple is now in good condition after several years of heavy damage. There are many large and shady trees around the temple, the temple garden is also well organized, and the rural environment adds to the beautiful atmosphere when visiting the temple (Tanjung Turaeni, 2016). Figure 1 below shows one of the ornaments in Kidal Temple.

Figure 1. The head of Batara Kala above the entrance gate of Kidal Temple.

Previous research related to the exploration of ethnomathematics in temples has been done. In the study Exploration of Geometric Concepts in the Geometric Medallion of Kidal Temple, it was found that in the Kidal Temple medallion, mathematical concepts were found in the form of flat geometry in the form of circles and quadrilaterals (Romadhon & Rosadi, 2024).

In the ethnomathematics exploration research on Brahu Temple Trowulan Mojokerto Regency, shows that in the temple can be found the concept of plane geometry consisting of square, rectangle, trapezoid, circle and triangle. And also found the concept of geometry in the form of blocks. In addition, the concept of arithmetic sequence was also found (Fajariyah et al., 2023). However, when researchers show the mathematical concepts that exist in the temple, researchers are remains subjective, without detailed elaboration.

Research on ethnomathematics in artifacts from the Singosari Kingdom revealed the application of various mathematical principles, including: Geometric forms (rectangular prisms, truncated square pyramids, squares, circles, octagons, triangles, and rhombuses), Geometric transformations (reflection and translation), Numerical patterns, and Traditional calculation systems.However, this study did not focus on a single object. Rather, it examined multiple artifacts from different locations (Wulandari & Budiarto, 2020). Additionally, the researchers presented the mathematical concepts identified in these objects through a subjective lens without detailed quantitative analysis.

Based on the results of research related to ethnomethematics that has been done before, in this study researchers will focus on ornamental ornaments in Kidal Temple. Then for the results found will be stated objectively.

Mathematical ideas and concepts in Kidal Temple in Figure 1 can be found starting from shape and size. In addition, the physical form of Kidal Temple is still intact and well preserved. Thus, the Kidal Temple can be used as an ethnomathematics object to explore and describe the mathematical concepts in the Kidal Temple building from East Java and its use in mathematics learning. Therefore, researchers will explore the ethnomathematics of Kidal Temple ornaments in geometry learning.

RESEARCH METHODS

This type of research is qualitative research using an ethnographic approach. In this study, researchers describe and analyze in depth the geometric shapes and patterns found in Kidal Temple ornaments. Ethnography is employed to examine and document behavioral patterns, belief systems, and linguistic practices within the cultural community through direct observational research. (Muftiyah & Sudihartinih, 2024). Using an ethnographic approach, the researcher aims to identify the geometric concepts embedded in the ornaments of Kidal Temple, as well as to understand and document their symbolic meanings. The data in the form of data on mathematical concepts in the Kidal Temple relics of the Singasari Kingdom were obtained from data collection in the form of studies from various literatures. Other data in the form of interviews and documentation with left-handed temple administrators are used to confirm and supplement the data. Data validity was checked using the triangulation technique (method), that

is, using more than one data collection technique to obtain the same data to check the validity of the data (Saadah et al., 2022).

For data analysis, the ethnographic approach proposed by Spradley (2006) was used, namely domain analysis, taxonomy analysis, component analysis, and cultural theme analysis. Domain analysis is the first step to obtain a general and comprehensive description of the research object. The next step is to analyze all the collected data based on the predetermined domain, where the analysis is called taxonomic analysis. Component analysis is an analysis of domain differences, where data collection is carried out by means of interviews, observations or realized documentation. Cultural analysis itself is a search for common threads that integrate existing domains, so that clear research objects are revealed (Safrudin et al., 2023).

RESULT AND DISCUSSION

Based on the results of observations made in Kidalrejo Village, Tumpang District, Malang Regency, data obtained that Kidal Temple has a size of 10.8m long, 8.36m wide, and the current temple height is 12.26m. The temple was built with andesite stone. Overall, the temple is divided into 3 parts, namely the foot of the temple, the body of the temple and the top of the temple.

The base of the temple foot is rectangular. At the foot of the temple there are tambha lion motifs and the last decoration is the relief of "Garudeya" which amounts to 3. At the foot of the temple there are 6 corners occupied by supporting lions and there are round medallion ornaments in which there are animal and plant ornaments. On the body of the temple there is a main chamber surrounded by other niches. The walls of the body of the temple are decorated with lower, middle and upper seams and are also decorated with circles (medallions) similar to those on the foot of the temple. The upper lintel of the niche is decorated with the head of Kala. The top of the collapsed temple is thought to be cube-shaped. The decoration on the top of the temple is a tumpal motif in the form of an inverted mountain. At each corner of the temple foot there are lion decorations and on the wall there are 3 garudeya decorations. On the body of the temple there is a main niche and niches facing each direction as well as 2 smaller niches to the right and left of the main niche. Above the door is a kala face decorated with symmetrical carvings. There is also a circular decoration with floral and mortal motifs. The roof of the temple becomes smaller and smaller, but it is not tapered because it is assumed that the top collapsed. There is a tumpal patterned decoration that looks like a triangular shape on the roof.

Based on observations of some ornaments of Kidal Temple, it was found that there are elements of geometry. The geometric elements are found in the temple decoration in the form of medallions, vine ornaments, and also on the roof of the temple. This is shown in accordance with the research area analysis shown in Table 1 below.

Table 1. Area Analysis

Object	Domain
Kidal Temple	Medalion
	Sulur motif ornament
	Temple roof

After the domain analysis, the next step is taxonomy analysis. The following research taxonomy analysis is shown in Table 2 below.

Table 2. Taxonomy Analysis

Math Concept	Domain
Square	Medallion Ornament
Circle	Medallion Ornament
Triangle	Temple roof

The following is an explanation of each ornament and the mathematical concepts contained therein.

Geometric Pattern on Medallion

Medallions are round or oval ornaments that contain sculptural or pictorial decoration on interiors, monuments, or furniture. In Great Britain, medallions were a popular form of decoration in neoclassical architecture in the 19th century (Monika Yudianto & Ratyaningrum, 2023). Within the circular motif there are also ornaments or reliefs. Ornaments in the form of medallions are found only in Kidal Temple and Penataran Temple (Halim, 2017).

Based on observations, there are 16 panels of medallion ornaments in Kidal Temple. In the religious context, the medallion symbolizes wisdom and knowledge, but it also symbolizes the concept of cosmic balance of the universe. The inside of the medallion is usually an image of an animal with a background of flora and fauna (Suhadak et al., 2022). The medallion at Kidal Temple, based on the observation results, has a perfect circle shape. In addition, according to research (Romadhon & Rosadi, 2024), the medallion at Kidal Temple has a diameter of 48.3 cm with a radius of 24.15 cm. In addition to the concept of a circle, one of the medallions also has a rectangular shape inside. The shape is similar to a rhombus, except that the sides are unequal in size. This is because the rhombus is a jajargenjang whose two sides are of equal length (Zulkarnain, 2021) (Zulkarnain, 2021). However, because it has 4 connecting lines and there are 4 corner points, it is a quadrilateral (Romadhon & Rosadi, 2024).

The following images of medallion ornaments on Kidal Temple are presented in Figure 2 and Figure 3.

Figure 2. Medallion ornaments with the concept of a circle

Figure 3. Medallion ornaments with the concept of a quadrilateral

Geometric Pattern on the Temple Roof

Based on the observations made, there is an ornament or motif in the form of a tumpal on the roof of the temple. The tumpal motif is an ornamental pattern motif in the form of a series of isosceles triangles. The tumpal motif symbolizes fertility. This motif is usually found on textiles. Although it is usually found in fabric motifs, the tumpal motif is also found in cani-candi in Java (Halim, 2017). he tumpal motif consisting of three sides has a magical meaning, namely the harmony between man, the universe and other nature or God (Sekartinah, Astuti, 2021). One of them is found in Kidal Temple. Therefore, the Tumpal motif can represent the concept of geometry in the form of a triangle. Because the tumpal motif itself has 3 sides connected by 3 vertices (Zulkarnain, 2021). The following picture of the Tumpal motif on the roof of the temple is shown in Figure 4.

Figure 4. The tumpal motif on the roof of the temple

Geometric Patterns in Vine or Flora Motif Ornaments

Flora motifs have been used as decoration since the Hindu influence in the archipelago. Flora motifs are usually combined with other natural objects. Not all floral motifs have a symbolic meaning, they are only used as decoration (Rahmawati et al., 2020). This motif is found on the foot of Kidal Temple. In the floral motifs at Kidal Temple, the concept of mirroring or reflection is found. Reflection (mirroring) is a transformation that moves each point on the plane by using the properties of shadows by a mirror (Istiqomah, 2020). The floral motifs on Kidal Temple are more precisely the application of the concept of geometry in the form of mirroring the y-axis. The following vine motifs on Kidal Temple are presented in Figure ss.

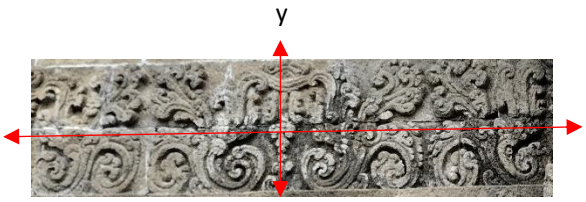

Figure 5. Sulur motif on Kidal Temple

The ethnomathematics findings presented above can be implemented in mathematics learning in order to help students learn. The application of the ethnomathematics approach in learning can help students more easily understand the material because it is closely related to their culture. Thus, the learning process becomes more effective. Previous research also proved that the use of cultural ornaments can bridge the understanding between geometry concepts in school and their application in everyday life (Muftiyah & Sudihartinih, 2024).

CONCLUSION AND SUGGESTION

Based on the research results that have been presented above, it can be concluded that the ornaments that decorate Kidal Temple implement mathematical concepts. The mathematical concept in the ornament represents the concept of flat shapes in geometry material. The concept of rectangular and circular flat shapes is found in medallion ornaments. The concept of triangular flat geometry is found in the tumpal ornament on the roof of the temple, then in the vine or floral ornament found at the foot of the temple applies the concept of reflection or mirroring of the x-axis. Based on the limitations carried out by researchers on the exploration of ethnomathematics of Kidal Temple Ornaments, the researchers also provide input and suggestions for further researchers such as learning flat buildings based on Kidal Temple Reliefs. This can certainly be used as a means of introducing mathematical concepts, especially geometry based on social science learning on the Kidal Temple Relief.

REFFERENCES

Fajariyah, L., Nasrulloh, M. F., & Zuhriawan, M. Q. (2023). Eksplorasi Etnomatematika pada Candi Brahu Trowulan Kabupaten Mojokerto. *Prosiding SENPIKA*, *1*.

Halim, A. (2017). the Meaning of Ornaments in the Hindu and Buddhist Temples on the Island of Java (Ancient - Middle - Late Classical Eras). *Riset Arsitektur (RISA)*, *1*(02), 170–191. https://doi.org/10.26593/risa.v1i02.2391.170-191

Hardiarti, S. (2017). Etnomatematika : Aplikasi Bangun Datar Segiempat pada Candi Muaro Jmabi. *Aksioma*, *8*(2), 99–110.

Istiqomah. (2020). Modul Pembelajaran SMA Matematika Peminatan (Transformasi Geometri Matematika Umum Kelas XI). In *Direktorat SMA*, *Direktorat Jendral PAUD, DIKDAS, DIKMEN*.

Kurnia, W. A., & Nugroho, A. M. (2015). Karakteristik Ruang Pada Rumah Tradisional Tanean Lanjhang Di Desa Bandang Laok Kecamatan Kokop, Kabupaten. *LANGKAU*

BETANG: JURNAL ARSITEKTUR, *2*(1). https://doi.org/10.26418/lantang.v2i1.13836

Marinka, D. O., Febriani, P., & Wirne, I. (2018). Efektifitas Etnomatematika dalam Meningkatkan Kemampuan Pemahaman Matematika Siswa Pendahuluan. *Jurnal Pendidikan Matematika Raflesia*, *03*(02), 171–176.

Muftiyah, S., & Sudihartinih, E. (2024). Etnomatematika Pada Ornamen Masjid Agung Kota Sukabumi. *Pedagogy: Jurnal Pendidikan Matematika*, *9*(1), 92–108. https://doi.org/10.30605/pedagogy.v9i1.3650

Rahmawati, F. E., Iksan, N., & R, A. S. (2020). Relief Candi Kidal Sebagai Ide Penciptaan Motif Batik Sri Wedhatama. *Jurnal Brikolase Online*, *12*(2), 95–108.

Romadhon, M. S., & Rosadi, R. I. M. (2024). Eksplorasi Konsep Geometri Pada Medalion Geometris Candi Kidal. *Math Educa Journa*, *8*(1), 35–46. http://ejournal.uinib.ac.id/jurnal/index.php/matheduca

Saadah, M., Prasetiyo, Y. C., & Rahmayati, G. T. (2022). Strategi Dalam Menjaga Keabsahan Data Pada Penelitian Kualitatif. *Al-'Adad : Jurnal Tadris Matematika*, *1*(2), 54–64. https://doi.org/10.24260/add.v1i2.1113

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

Suhadak, A., Arimbawa, A. A. G. R., & Sidyawati, L. (2022). Cerita pada ornamen medalion di relief candi Penataran sebagai ide penciptaan batik lukis. *Imaji*, *20*(2), 157–171. https://doi.org/10.21831/imaji.v20i2.51492

Tandililing, P. (2015). Etnomatematika Toraja (Eksplorasi Geometris Budaya Toraja). *Jurnal Ilmiah Matematika Dan Pembelajarannya*, *1*(1), 47–57.

Tanjung Turaeni, N. N. (2016). Aplikasi Adi Parwa dalam Relief Situs Candi Kidal. *Forum Arkeologi*, *28*(2). https://doi.org/10.24832/fa.v28i2.27

Wayan, N., Permana, D., Agung, I. G., & Yasna, I. M. (2023). *Pembelajaran Bangun Datar dalam Etnomatematika Jejahitan Bali (Kajian Pustaka). 21*(1), 74–81.

Wulandari, D., & Budiarto, M. T. (2020). Etnomatematika : Eksplorasi Pada Artefak Kerajaan Singosari. *Transformasi : Jurnal Pendidikan Matematika Dan Matematika*, *4*(1), 203–217. https://doi.org/10.36526/tr.v4i1.905

Zaenuri, & Dwidayati, N. (2018). Exploring ethnomathematics: mathematics as a cultural product. Prisma, proceedings of the national mathematics seminar,. *PRISMA, Prosiding Seminar Nasional Matematika*, *1*(1), 471–476.

Zulkarnain. (2021). *Konsep Dasar Materi Geometri Tingkat Sekolah Dasar (SD)/Madrasah Ibtidaiyah (MI)* (Issue April). IAIN Pontianak Press.