PROSIDING DISKUSI PANEL NASIONAL PENDIDIKAN MATEMATIKA

Original Research

An Ethnomathematics Study of Geometric Concepts in the Banten Batik Motifs Pangindelan Mas, Kasunyatan, and Madhe Mundu

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INFO ARTICLES

Key Words:
Ethnomathematics; Banten Batik; Geometry; Geometric Transformation.

Abstract**:** *This study aims to explore the geometric concepts found in the Banten batik motifs of Pangindelan Mas, Kasunyatan, and Madhe Mundu from an ethnomathematical perspective. This research employed a descriptive qualitative approach through observation, documentation, and visual analysis of the motifs. The findings revealed various plane geometric concepts, including circles, triangles, rhombuses, rectangles, and ellipses. In addition, geometric transformations such as translation, reflection, and rotation were identified in the arrangement and repetition of motif elements. These findings indicate that Banten batik motifs contain mathematical concepts that can be utilized as contextual learning resources in mathematics education. Furthermore, the study highlights the role of ethnomathematics in integrating local culture into mathematics learning while supporting the preservation of cultural heritage.*

Abstrak: Penelitian ini bertujuan untuk mengeksplorasi konsep-konsep geometri yang terdapat dalam motif batik Banten Pangindelan Mas, Kasunyatan, dan Madhe Mundu dari perspektif etnomatematika. Penelitian ini menggunakan pendekatan kualitatif deskriptif melalui observasi, dokumentasi, dan analisis visual terhadap motif-motif tersebut. Temuan penelitian menunjukkan adanya berbagai konsep geometri datar, termasuk lingkaran, segitiga, belah ketupat, persegi panjang, dan elips. Selain itu, transformasi geometris seperti translasi, refleksi, dan rotasi teridentifikasi dalam susunan dan pengulangan elemen-elemen motif. Temuan ini menunjukkan bahwa motif batik Banten mengandung konsep-konsep matematika yang dapat dimanfaatkan sebagai sumber belajar kontekstual dalam pendidikan matematika. Lebih lanjut, penelitian ini menyoroti peran etnomatematika dalam mengintegrasikan budaya lokal ke dalam pembelajaran matematika sekaligus mendukung pelestarian warisan budaya.

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How to Cite (APA 6th Style): Amroh, Nurhaniyah, F., Kusuma, Hamidah, & Ayuningtyas, V. (2026). An Ethnomathematics Study of Geometric Concepts in the Banten Batik Motifs Pangindelan Mas, Kasunyatan, and Madhe Mundu. *Prosiding Diskusi Panel Nasional Pendidikan Matematika*, 521-528.

INTRODUCTION

Batik is one of Indonesia's cultural products that blends aesthetics, history, identity, and local knowledge. The arrangement of batik motifs is not only built through decorative elements but also demonstrates regularity of form, repetition, symmetry, and spatial relationships. These characteristics make batik relevant for study through ethnomathematics—a field that examines mathematical ideas and practices within the cultural context of a society (D'Ambrosio, 1985). In mathematics education, the ethnomathematics approach can bridge formal concepts with students' cultural experiences, so that mathematics is understood as knowledge closely tied to daily life—not merely a collection of symbols and formulas detached from reality (Rosa & Orey, 2011).

Geometry is one of the mathematical concepts frequently represented in batik motifs. Shapes such as circles, triangles, rectangles, rhombuses, and ovals can be identified by their ornamentation. At the same time, translation, reflection, rotation, and dilation can be traced through repetition, mirroring, changes in orientation, or changes in motif size. Research on Sasambo Batik, for example, identified the concepts of translation, reflection, rotation, and dilation in its motif arrangements (Hadi et al., 2022). In the context of Banten, Krakatoa Cilegon Batik is also known to incorporate mathematical activities and concepts that can be integrated as a learning resource for junior high school mathematics (Amalia et al., 2021). These findings indicate that analyzing batik motifs can provide a concrete context for introducing geometric concepts while simultaneously fostering an appreciation for local culture.

Banten batik possesses visual characteristics tied to the history and culture of the Sultanate of Banten. The names, shapes, and arrangements of its motifs frequently reference historical artifacts, spaces, and terms that are integral to Banten culture. Among these motifs are Pangindelan Mas, Kasunyatan, and Madhe Mundu. All three feature distinct compositions of ornamentation, basic shapes, repeating patterns, and arrangement directions. These differences open the possibility of identifying variations in plane geometry concepts and geometric transformations within each motif.

Several studies have examined ethnomathematics in batik from the Banten region. Mahuda (2020) identified philosophical values and mathematical concepts in Lebak batik. Subekhi et al. (2021) discovered plane geometric shapes in Lebak batik motifs, while Firdaussa et al. (2021) elaborated on the philosophical values and concepts of geometric transformations in traditional Banten batik. Other studies highlight the potential of Cilegon Krakatoa batik as a resource for mathematics education (Amalia et al., 2021), the presence of diverse geometric concepts in Cilegon batik motifs (Syam & Pujiastuti, 2023), and geometric concepts in Pandeglang batik that can be applied in educational settings (Solihin & Pujiastuti, 2023). This series of studies confirms that batik from various regions of Banten contains mathematical knowledge worth exploring.

However, previous studies have generally focused on the motifs of Lebak, Cilegon, and Pandeglang batik, or on Banten batik more broadly. Studies specifically comparing the geometric representations in the Pangindelan Mas, Kasunyatan, and Madhe Mundu motifs remain limited in the reviewed literature.

Furthermore, these three motifs have not yet been extensively mapped together based on two categories of analysis: plane geometry and geometric transformations. This gap is important to examine because similarities in repeating patterns do not necessarily indicate the same type of transformation. At the same time, differences in ornamentation may represent distinct characteristics of plane figures. Therefore, the analysis must be based on the geometric features visible in each motif, not merely on general visual impressions. Based on this discussion, this study aims to explore and describe the geometric concepts found in the Banten Batik motifs Pangindelan Mas, Kasunyatan, and Madhe Mundu from an ethnomathematics perspective. The analysis focuses on plane geometric shapes and geometric transformations identified through the arrangement, repetition, symmetry, and orientation of the ornaments. The novelty of this study lies in the comparative mapping of geometric concepts across these three motifs within a single study. The results are expected to enrich the ethnomathematical documentation of Banten Batik and provide a conceptual foundation for the

development of contextual geometry learning resources oriented toward the preservation of local culture.

METHOD

This study employs a qualitative descriptive approach from an ethnomathematics perspective. The qualitative approach was chosen because the study focuses on interpreting the visual characteristics and mathematical regularities found in cultural products, rather than on testing hypotheses or measuring relationships between variables (Creswell & Poth, 2018). The research subjects are geometric concepts in three Banten batik motifs: Pangindelan Mas, Kasunyatan, and Madhe Mundu. The concepts examined include plane geometry and geometric transformations evident in the shape, position, orientation, symmetry, and repetition of the ornaments.

Data collection was conducted at Batik Mukarnas Banten on Saturday, May 16, 2026. The primary data source consisted of visual representations of the three batik motifs observed directly. Supporting data were obtained from field notes, photographic documentation, and verbal information provided by the artisans regarding the production process and the meanings of the motifs during the observation activities. The three motifs were selected because they were available at the research site, had clearly observable visual structures, and exhibited variations in shape and ornamental arrangement relevant to the geometric study's focus. Data collection techniques consisted of direct observation, documentation, and limited participation. Observations were conducted by examining the basic shapes, the positions of the ornaments relative to one another, the direction of repetition, axes of symmetry, and changes in orientation within each motif. Documentation was conducted using a digital camera to capture images of the motifs for later review, while field notes recorded contextual information from the artisans and the observation process. Limited participation in batik-dyeing activities was used to help the researcher understand the arrangement of motifs and the production stages. However, it was not presented as the sole source for defining geometric concepts. In this study, the researcher acted as the primary instrument, aided by a digital camera and field notes.

RESULTS AND DISCUSSION

This study highlights several geometric concepts, including plane figures and geometric transformations. The geometric concepts identified by the researcher are derived from three Banten batik motifs: Kasunyatan, Madhe Mundu, and Pangindelan Mas. The analysis identified visual patterns in each motif to uncover these geometric concepts.

Motif Kasunyatan

Figure 1. Banten Batik with the Kasunyatan Motif

Figure 1 shows the Kasunyatan motif, which is dominated by circular ornamental patterns arranged in a repetitive pattern. The analysis reveals that this motif incorporates concepts of plane

geometry, namely circles and rhombuses. Circles are visible in the main ornaments, while rhombuses are found in the filler ornaments located between the main motifs and along the edges of the batik. In addition to the concepts of plane figures, the Kasunyatan motif also incorporates concepts of geometric transformations, namely translation, reflection, and rotation. The concept of translation is evident in the regular repetition of the motifs, both horizontally and vertically. The concept of reflection is evident in the symmetry of certain ornaments relative to specific axes. In contrast, the concept of rotation is evident in the main motif, which exhibits 180 ° rotational symmetry. Thus, the Kasunyatan motif demonstrates a connection between cultural aesthetic elements and mathematical concepts, particularly in the study of geometry.

Motif Madhe Mundu

Figure 2. Banten Batik with the Madhe Mundu Motif

Based on Figure 2, several two-dimensional geometric shapes were identified, including triangles, rhombuses, rectangles, and ovals. Triangular shapes are visible in the border ornaments of the motifs, while rhombuses are found in the main ornaments located in the center of the patterns. Rectangles appear in the motif's border, while ovals are found in the decorative ornaments arranged in a repeating pattern. Additionally, geometric transformations such as reflection and translation were identified. Reflection is evident in the arrangement of motifs that are symmetrical about an axis, while translation is evident in the horizontal repetition of oval shapes arranged in a regular pattern.

Motif Pangindelan Mas

Figure 3. Bantik Banten with the Pangindelan Mas Motif

Based on Figure 3, several two-dimensional geometric shapes were identified, including circles, rhombuses, and rectangles. Circular shapes are visible in the filler ornaments scattered throughout the main motif. Rhombus shapes are found in the ornaments located in the center of the motif's border, while rectangles are visible in the frame or outline of the motif pattern.

In addition to two-dimensional shapes, concepts of geometric transformations—specifically reflection and translation—were also identified. Reflection is evident in the arrangement of ornaments that exhibit symmetry across the horizontal axis. Meanwhile, translation is evident in the vertical repetition of the main motif, which maintains the same shape and size. The research findings indicate that the three Banten Batik motifs examined consistently incorporate concepts of two-dimensional shapes and geometric transformations, including translation, reflection, and rotation. These transformations serve not only aesthetic purposes but also reflect mathematical regularity and patterns that can be systematically analyzed.

DISCUSSION

Concepts of Plane Geometry in Banten Batik Motifs

The research findings indicate that the Pangindelan Mas, Kasunyatan, and Madhe Mundu motifs incorporate various concepts of plane geometry, which are expressed through the shapes of their constituent ornamental elements. The Kasunyatan motif features circles and rhombuses, while the Madhe Mundu motif incorporates triangles, rhombuses, rectangles, and ovals. The Pangindelan Mas motif, meanwhile, features circles, rhombuses, and rectangles.

Mathematically, these plane figures possess distinct characteristics. The circles in the Kasunyatan and Pangindelan Mas motifs are shapes in which the distance from the center to every point on the circumference is equal. This shape creates a sense of harmony and balance within the motif. Meanwhile, the rhombuses found in all three motifs are two-dimensional shapes with four equal sides and fold symmetry, resulting in orderly, proportional patterns.

The Madhe Mundu motif features a wider variety of two-dimensional shapes compared to the other motifs. The presence of triangles conveys a sense of direction and pattern definition, while rectangles serve as borders or frames for the motifs, reinforcing the batik's visual structure. The ovals in the decorative ornaments represent variations on the circle shape, adding aesthetic variety to the motifs. This diversity of shapes indicates that the arrangement of batik motifs is not random but rather employs geometric principles to produce balanced, visually appealing compositions.

This finding aligns with research by Mahuda (2020) and Syam and Pujiastuti (2023), who discovered that Banten batik motifs contain various geometric shapes that can serve as a resource for mathematics education. The presence of plane figures in batik motifs indicates that geometric concepts have been part of the community's cultural practices, even though they are not formally expressed as symbols or mathematical formulas.

Concepts of Geometric Transformations in Banten Batik Motifs

In addition to plane geometry, the three Banten Batik motifs also demonstrate geometric transformations, including translation, reflection, and rotation. The most dominant transformation is translation, which is found in all motifs. Mathematically, translation is the movement of a shape from one position to another without changing its size or shape. In batik motifs, translation is evident in the repetition of ornaments arranged horizontally or vertically in identical patterns.

The use of translation in batik motifs serves both aesthetic and structural functions. Aesthetically, the repetition of shapes creates an appealing visual rhythm. Mathematically, translation produces pattern regularity, ensuring the motif appears consistent across the entire fabric surface. This characteristic is one of the primary features of traditional batik motifs, which rely on pattern repetition as a key design element.

The concept of reflection is found in all three motifs through the arrangement of symmetrical ornaments about a central axis. In geometry, reflection is the mirroring of an object across a specific line, resulting in congruent shapes. The presence of reflection in batik motifs indicates that artisans intentionally created a principle of visual balance. This balance makes the motifs appear harmonious and proportional.

Meanwhile, the concept of rotation is found in the Kasunyatan motif. Rotation is a transformation that rotates a shape around a specific center point by a certain angle without altering

its shape or size. The presence of rotation in the Kasunyatan motif indicates that batik patterns are not only constructed through linear repetition but also through the arrangement of shape orientations, which creates visual variation. This finding aligns with the research by Hadi et al. (2022) and Toha et al. (2024), who found that translation, reflection, and rotation are geometric transformation concepts commonly found in various batik motifs across Indonesia.

An Ethnomathematics Perspective on Banten Batik Motifs

From an ethnomathematics perspective, the presence of plane figures and geometric transformations in the Pangindelan Mas, Kasunyatan, and Madhe Mundu motifs indicates that batik-making embodies mathematical knowledge that has evolved within the community's culture. Batik artisans apply geometric concepts through pattern repetition, symmetrical arrangement, and the proportional placement of ornaments, even though they do not always use formal mathematical terminology. This finding supports the view that mathematics is an integral part of cultural activities that grow and evolve within a community's way of life. Ethnomathematics holds that mathematical concepts can be found in various cultural products, including batik motifs. Therefore, Banten batik not only possesses aesthetic and historical value but also has the potential to serve as a contextual learning medium. The use of batik motifs in geometry instruction can help students connect abstract mathematical concepts with cultural objects they are familiar with, thereby making learning more meaningful and relevant. These findings align with various ethnomathematics studies showing that integrating local culture into mathematics instruction can enhance conceptual understanding and make learning more contextual.

CONCLUSION

Based on the research findings and discussion, it can be concluded that the Banten Batik motifs Pangindelan Mas, Kasunyatan, and Madhe Mundu incorporate various geometric concepts that can be examined from an ethnomathematics perspective. The geometric plane concepts identified include circles, triangles, rhombuses, rectangles, and other shapes evident in the ornamental elements that make up the motifs. Additionally, geometric transformation concepts such as translation, reflection, and rotation were identified, as evidenced by the repeating patterns, symmetry, and the arrangement of ornaments within each motif.

The Kasunyatan motif features plane geometric concepts such as circles and rhombuses, as well as geometric transformations including translation, reflection, and rotation. The Madhe Mundu motif incorporates plane figures such as triangles, rhombuses, rectangles, and ovals, along with geometric transformations including translation and reflection. Meanwhile, the Pangindelan Mas motif incorporates concepts of plane geometry—such as circles, rhombuses, and rectangles—as well as geometric transformations, including translation and reflection. The findings of this study indicate that Banten Batik motifs possess aesthetic and cultural value and also contain mathematical concepts that are indirectly applied in the batik-making process. Therefore, Banten batik motifs have the potential to be utilized as a contextual learning resource for lessons on plane geometry and geometric transformations. In addition to supporting the understanding of mathematical concepts, the use of batik motifs in education can also enhance students' appreciation of local culture and support efforts to preserve Banten's cultural heritage.

REFERENCES

Amalia, A., Syamsuri, & Ihsanudin. (2021). Eksplorasi etnomatematika Batik Krakatoa Cilegon sebagai sumber belajar matematika SMP. *Wilangan: Jurnal Inovasi dan Riset Pendidikan Matematika*, *2*(1), 36–43. https://doi.org/10.56704/jirpm.v2i1.11640

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches* (4th ed.). Thousand Oaks, CA: SAGE Publications.

D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, *5*(1), 44-48. https://doi.org/10.2307/40247876

Firdaussa, T. S., Nurasih, N., Anita, Purwaningsih, Z., Nisa, K., & Kusuma, J. W. (2021). Etnomatematika batik khas Banten, nilai filosofis dan materi transformasi geometri bagi siswa SMA. *Himpunan: Jurnal Ilmiah Mahasiswa Pendidikan Matematika*, *1*(2), 169-178.

Hadi, H. S., Supiarmo, M. G., Hidayat, M. Q., & Ajimuliardi, L. (2022). Ethnomathematics: Concept of transformation geometry in Sasambo batik motifs Bale Lumbung Sasak. *Jurnal Pendidikan Matematika Raflesia*, *7*(1), 44-52. https://doi.org/10.33369/jpmr.v7i1.20659

Mahuda, I. (2020). Eksplorasi etnomatematika pada motif Batik Lebak dilihat dari sisi nilai filosofi dan konsep matematis. *Jurnal Lebesgue: Jurnal Ilmiah Pendidikan Matematika, Matematika dan Statistika*, *1*(1), 29-38. https://doi.org/10.46306/lb.v1i1.10

Rosa, M., & Orey, D. C. (2011). Ethnomathematics: The cultural aspects of mathematics. *Revista Latinoamericana de Etnomatematica*, *4*(2), 32-54.

Solihin, S. A., & Pujiastuti, H. (2023). Etnomatematika: Eksplorasi Batik Pandeglang ditinjau dari konsep matematika geometri. *J-PiMat: Jurnal Pendidikan Matematika*, *5*(1), 765-774. https://doi.org/10.31932/j-pimat.v5i1.2346

Subekhi, A. I., Nindiasari, H., & Sukirwan. (2021). Etnomatematika: Tinjauan aspek geometris Batik Lebak Provinsi Banten. *JNPM (Jurnal Nasional Pendidikan Matematika)*, *5*(1), 81-93. https://doi.org/10.33603/jnpm.v5i1.3577

Syam, S. S., & Pujiastuti, H. (2023). Eksplorasi etnomatematika pada motif Batik Cilegon ditinjau dari konsep geometri. *J-PiMat: Jurnal Pendidikan Matematika*, *5*(1), 671-682. https://doi.org/10.31932/j-pimat.v5i1.2336

Toha, A. M., Septi, A. D., Astuti, W., & Bisri, M. (2024). Ethnomathematics of Kawung Solo batik as a learning media for STREAM-based geometry transformation. *EDUCATOR: Jurnal Inovasi Tenaga Pendidik dan Kependidikan*, *4*(2), 89-102. https://doi.org/10.51878/educator.v4i2.3668