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Ethnomathematical Exploration of Two-Dimensional Shapes in Banten Batik Motifs

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Abstract

Indonesia is currently implementing an independent curriculum that emphasizes contextual, differentiated, and learner-centered instruction grounded in students' cultural environments. Integrating local heritage, such as batik, aligns with these principles and allows students to recognize mathematics as part of their everyday experiences rather than a detached school subject. Typical Banten batik, therefore, holds strong potential as a medium for teaching geometry. This study aims to identify and analyze the plane shapes embedded in Banten batik motifs. A descriptive qualitative method with an ethnographic approach was employed. Data were collected through literature review, interviews, and direct observations of Banten batik, and were analyzed using domain and taxonomic techniques to classify and interpret geometric features. The findings show that Banten batik motifs contain plane geometric elements that represent mathematical concepts naturally embedded in local culture, demonstrating clear connections with flat shapes. The study highlights the significant potential of ethnomathematics-based learning, enabling teachers to connect formal mathematics with students' cultural knowledge, promote meaningful learning, and strengthen students' cultural identity and pride.

Keywords: Banten Batik; Ethnomathematical; Two-Dimensional Shapes

1. Introduction

Indonesia is a country rich in cultural heritage, customs, and artistic expressions that have developed over centuries (Fadilah et al., 2023; Hayati et al., 2024; Yuono, 2024). One of the most prominent cultural assets is batik, which has become both a national identity and a world-recognized heritage (Puspitasari et al., 2022; Simanjuntak et al., 2023). Beyond its visual beauty, batik carries symbolic historical, social, religious, and philosophical meanings (Adhitama et al., 2023; Fattah et al., 2023; Suliastuti, 2025; Takdir & Hosnan, 2021). Its recognition by UNESCO as intangible cultural heritage further highlights its role as a medium for transmitting traditional values and local knowledge (Ananda et al., 2025; Kasiyun et al., 2024; Pasaribu et al., 2024; Puspitasari et al., 2022; Simanjuntak et al., 2023). Among Indonesia's diverse regional motifs, Banten batik reflects natural beauty, local wisdom, and regional belief systems, embodied in motifs such as Kapurban, Tambakbaya, Kalimaya, Tapak Kebo, Tari Rampak Bedug, Leuit Salisung Pare Sapocong, and Gipang (Aulia & Kusnaedi, 2024; Asyam et al., 2024; Rachma & Amrullah, 2024; Simanjuntak et al., 2023). These motifs are not merely artistic expressions but cultural narratives that visualize the identity, worldview, and collective memory of the Banten people.

Although batik has often been approached from cultural and aesthetic perspectives, its embedded mathematical structures have not been widely examined. Many motifs contain patterns, shapes, symmetries, and geometric structures, providing strong potential as contextual learning media in mathematics education (Astriandini & Kristanto, 2021; Bustan et al., 2022; Harkeni, 2021; Maulida et al., 2023; Pasaribu et al., 2024; Serepinah et al., 2023). The mathematical richness within batik remains an underutilized educational resource, especially in supporting meaningful learning aligned with students' cultural backgrounds. An ethnomathematics approach bridges cultural practices and mathematical understanding by interpreting mathematical ideas through cultural lenses (Hardiarti, 2017; Wardani et al., 2023). This approach is particularly relevant in Indonesia, where cultural diversity is vast and offers abundant opportunities for connecting mathematics to real-life contexts.

Bishop views mathematics as a cultural product embedded in human activities, grown from cultural skills and symbolic technologies (Lestari et al., 2024; Yolanda & Putra, 2022). Thus, mathematical thinking is influenced by cultural experiences (Mauleto, 2025; Turmuzi et al., 2022). Rosa and Orey (2020) highlight that ethnomathematics recognizes the diversity of mathematical practices embedded in cultural life, reflecting how mathematical knowledge evolves from human experiences and sociocultural contexts. This perspective allows mathematics to be understood not only as an abstract discipline but also as a living knowledge expressed through everyday cultural activities (Sari et al., 2024; Trisnawati et al., 2024). Through this approach, students can relate classroom mathematics to their cultural identity and foster a sense of pride and appreciation for their local heritage (Masae & Tang, 2023; Nuryami & Apriosa, 2024; Setiani et al., 2023). Ethnomathematics encompasses mathematical ideas practiced in communities, including grouping, measuring, designing, pattern making, comparing, and locating, illustrating that mathematics naturally emerges from cultural environments rather than existing solely as an abstract academic discipline (Nuryami & Apriosa, 2024; Serepinah et al., 2023).

The relevance of ethnomathematics is strengthened by the Independent Curriculum, which promotes contextual and differentiated learning linked to students' environment (Palayukan et al., 2025; Saragih & Marpaung, 2024). This curriculum encourages teachers to employ local wisdom and cultural artefacts as learning resources, thus helping students perceive mathematics as part of everyday life rather than distant and abstract knowledge. Among the various mathematical concepts, geometry, particularly plane geometry, offers strong opportunities for contextual integration with cultural objects such as batik. Plane geometry includes two-dimensional shapes, their properties, symmetry, perimeter, and area, but is often taught in a decontextualized and abstract manner (Amalia & Arifin, 2023; Nursyahidah et al., 2021; Solihin & Rahmawati, 2024; Suryaningsih & Munahefi, 2021). Such abstract delivery may cause students to struggle in understanding geometric ideas and diminish their interest in learning mathematics (Amalia & Arifin, 2023; Juanti et al., 2021).

Several Banten batik motifs contain two-dimensional geometric elements that can support geometry learning through observation and reconstruction of patterns (Dita et al., 2024; Jatayu et al., 2024; Mahmudah & Arif, 2022). These motifs visually represent squares, rhombuses, triangles, trapezoids, circles, and kites, embedded in aesthetically meaningful patterns. Research has shown that cultural media such as Krebet wooden batik can introduce mathematical concepts, including angles, polygons, circles, and transformations, indicating that cultural artefacts can serve as powerful pedagogical tools (Abdullah & Rahmawati, 2021). Similarly, Qurani et al. (2024) found that Betawi batik contains numerous flat shapes, pattern structures, and spatial forms that can foster mathematical understanding through contextual observation and analysis. Collectively, these studies affirm that cultural artefacts possess substantial potential for enriching mathematics learning by linking abstract concepts to tangible cultural representations.

Despite the existing research, studies specifically examining typical Banten batik within the framework of ethnomathematics remain limited. Prior works have explored mathematical elements in various regional batiks, yet several gaps remain. First, there is limited research focusing on Banten batik specifically, even though its motifs differ historically and symbolically from batik in other regions. Second, previous studies often identify mathematical shapes at a surface level. In contrast, detailed geometric structural mapping, such as examining regularity, identifying specific plane shapes, analyzing lines of symmetry, and interpreting geometric transformations, has not been comprehensively conducted. Third, the integration of such analyses into concrete classroom applications, such as the development of contextual learning media or ethnomathematics-based teaching materials, is still underexplored. These gaps highlight the need for more systematic and focused research that not only identifies mathematical elements in Banten batik but also analyzes their structures deeply and translates the findings into educational practice.

Therefore, this study offers novelty in three aspects: (1) focusing on Banten batik as a culturally distinct object rarely discussed in mathematics education research; (2) conducting a detailed exploratory and visual analysis of its geometric structures, including plane shapes, symmetry, and repeating patterns; and (3) generating outputs that support the development of culturally grounded learning media. These contributions are expected to enrich the body of ethnomathematics research in Indonesia while strengthening the integration of cultural heritage within the mathematics curriculum.

This study aims to explore and analyze plane shape concepts embedded in typical Banten batik motifs. The specific objectives include: (1) identifying the forms of plane shapes contained in Banten batik motifs; (2) analyzing regularity, symmetry, and geometric patterns present in the motifs; and (3) formulating the potential use of these motifs as contextual and culture-based mathematics learning media. The results are expected to contribute to inclusive, creative, and contextual mathematics learning, as well as support cultural preservation through educational integration.

2. Method

This research was conducted in Cipocok Jaya District, Serang City, for three months using a descriptive qualitative method that explored Banten's typical batik in mathematics learning through an ethnographic approach. Ethnography was selected because it provides a systematic way to describe, explore, and analyze cultural elements within a community (Abdullah & Rahmawati, 2021). In this study, the researcher served as the main research instrument and was responsible for planning the research, collecting data, conducting field observations, carrying out interviews, analyzing and interpreting data, as well as compiling the final report. Data collection was carried out through literature studies, interviews, and direct observations of processes and motifs related to Banten's typical batik. The participants in this research consisted of individuals working at Batik Banten Mukarnas, a middle-class garment industry (Trenggonowati et al., 2020). They were selected because of their active involvement in motif creation, their familiarity with the philosophy of Banten motifs, and their experience in the batik production process.

Interviews were conducted in a semi-structured manner to provide flexibility while maintaining focus on cultural meanings, motif construction, and visual regularities relevant to ethnomathematical analysis. Observations were conducted both non-participatively and participatively to document motif forms, identify repeated patterns, and analyze geometric structures that appear in selected Banten motifs. Documentation included photographic recording of motifs, field notes, sketches of pattern units, and descriptions of artisan explanations. All collected data were analyzed using domain and taxonomic analysis. Domain analysis aimed to obtain a general classification of ethnomathematical elements, particularly geometric concepts embedded in batik motifs, while taxonomic analysis described the selected geometric elements in more detailed and structured forms. These analyses produced a hierarchical understanding of shape types, symmetry structures, pattern repetitions, and geometric relationships found in Banten batik.

A visual representation of the methodological sequence is provided to enhance the clarity of the research procedures. Figure 1 illustrates the structured progression of the study, beginning with the initial observations and extending through the conclusion phase.

Figure 1. Research Flow

To ensure the validity of the findings, triangulation techniques were applied by comparing information across different data sources, employing multiple data collection techniques, and conducting member-checking sessions with artisans to verify interpretations. The sequential stages of the research process are illustrated in Figure 1, which visualizes the overall methodological flow. The diagram begins with initial observations that led to the formulation of the research question, followed by an intensive literature review to establish the theoretical foundation. It then moves into the main data collection cycle consisting of observation and semi-structured interviews, which are complemented by documentation activities. These three components interactively support each other, ensuring that visual data, artisan explanations, and contextual information remain aligned. The figure concludes with the final stages of the study, namely data analysis, results and discussion, and the formulation of conclusions. This visual representation helps clarify how the research proceeded systematically from preliminary inquiry to analytical interpretation.

3. Results and Discussion

3.1 Results

Banten Batik has distinctive and unique characteristics because its motifs tell stories about history and originate from cultural relics such as pottery, ancient ornaments, and names related to worship practices of the Banten Kingdom. The motifs explored in this study include Kapurban, Tambakbaya, Kalimaya, Tapak Kebo, Tari Rampak Bedug, Leuit Salisung Pare Sapocong, and Kue Gipang. In general, these motifs display visual structures that not only carry philosophical meaning but also embed mathematical regularity, particularly in the realm of plane geometry. The results focus on identifying flat shapes that appear in these motifs and describing the geometric logic that underlies each pattern.

3.1.1 Identification of Flat Shapes

The analysis found that each motif incorporates recognizable geometric components such as squares, rectangles, rhombuses, triangles (right and acute), circles, trapezoids, and kites. Although these shapes appear in decorative forms, they remain mathematically valid and can be classified through domain and taxonomic analysis. More importantly, the structures are not randomly placed but are arranged through culturally meaningful rules of repetition, symmetry, proportionality, and transformation.

3.1.2 Motif-by-Motif Geometric Findings

The following explains the mathematical concepts contained in the Banten batik motifs, namely:

a. Kapurban Motif

The Kapurban motif is a Banten batik motif that is recognized by UNESCO and has a philosophy, namely, the name Kapurban is taken from the name of Prince Purba, son of Sultan Ageng Tirtayasa, which has the meaning of illustrating Prince Purba who has a firm, honest, and sincere nature (Safira et al., 2021). The motif integrates basic geometric shapes such as the square, rectangle, circle, and rhombus. The deliberate use of symmetrical arrangements reflects the cultural values of balance and sincerity. The repetition of diamond and square structures forms a grid-based tiling, suggesting a visual logic rooted in order, stability, and harmony. The overall illustration of the Kapurban motif is presented in Figure 2 below:

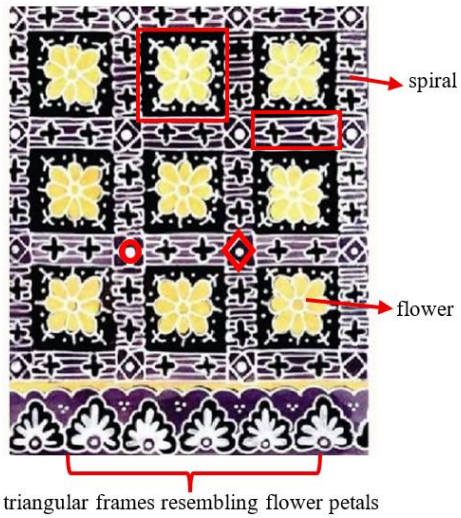

Figure 2. Kapurban Batik

Figure 2 displays the Kapurban batik motif, characterized by the incorporation of geometric concepts including the square, rectangle, circle, and rhombus. The design prominently features a basic ketupat (diamond/rhombus) unit decorated with flowers, spirals, and triangular frames resembling flower petals.

The core geometric shapes identified in the Kapurban Motif are shown in Figure 3 below:

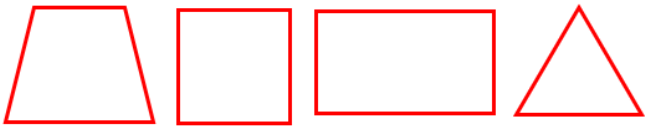

Figure 3. Square, Rectangle, Circle and Rhombus

Figure 3 highlights the fundamental geometric shapes: the square, rectangle, circle, and rhombus, which are organized into a tessellation-like array, demonstrating the motif's underlying mathematical structure.

b. Tambakbaya Motif

The Tambakbaya motif, originating from Lebak batik, is named after the location of the palace building where the night guard resided (Syari et al., 2022). The motif incorporates the geometric concepts of the rhombus and the circle. Geometrically, the rhombus units are arranged using translational symmetry, creating a rhythmic pathway that mirrors the layout of the palace surroundings. Circular ornaments provide contrast and function as rotational centers, symbolizing cultural ideas of movement and protection associated with the night guard. An illustration of the overall Tambakbaya motif is presented in Figure 4 below:

Figure 4. Tambakbaya Motif

Figure 4 shows the Tambakbaya motif, which applies the geometric concepts of the rhombus and the circle. The design also features stylized floral and leafy motifs, teardrop elements, and undulating wave bands, which introduce an organic rhythm to the overall pattern.

The core geometric shapes identified in the Tambakbaya Motif are shown in Figure 5 below:

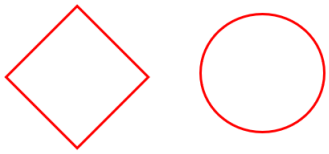

Figure 5. Rhombus and Circle

Figure 5 highlights the fundamental geometric shapes found in the motif, namely the rhombus and the circle, often arranged sequentially.

c. Kalimaya motif

Kalimaya is a type of precious stone that is an icon of the natural wealth of Lebak Regency, which is already famous abroad. This Kalimaya stone can be found in Maja, Curugbitung, Sajira, and

Cimarga Districts, which are usually used as raw materials for making rings. In addition to the Kalimaya stone, additional ornaments in this motif are bamboo, angklung, and one of the motifs from Baduy weaving (Apriyani et al., 2021).

Mathematically, the motif features the right triangle and the rectangle. These shapes primarily appear in the corner cuts of the gemstone representation, arranged in a repeated triangular tiling. The visual contrast between the rectangular blocks and triangular segments creates a visual segmentation analogous to the facets of a gemstone. The overall illustration of the Kalimaya motif is presented in Figure 6 below:

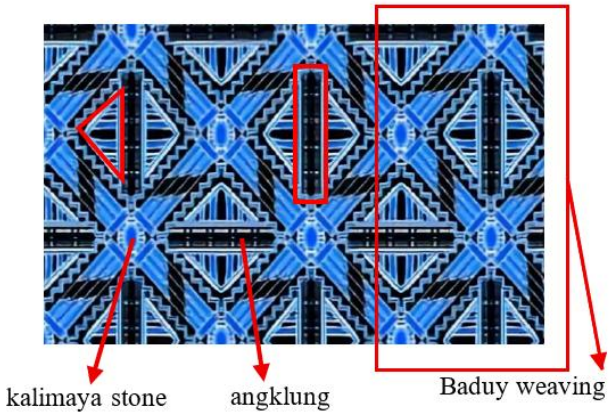

Figure 6. Kalimaya Motif

Figure 6 displays the Kalimaya motif, which utilizes the geometric concepts of the right triangle and the rectangle. The design emphasizes the Kalimaya stone ornament as the central element, complemented by additional ornaments such as the angklung and Baduy weaving motifs.

The core geometric shapes identified in the Kalimaya Motif are shown in Figure 7 below:

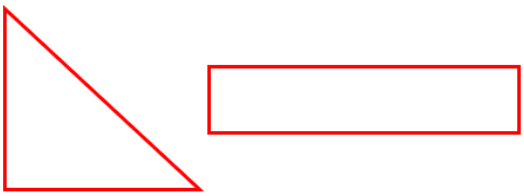

Figure 7. Right Triangles & Rectangles

Figure 7 highlights the two key geometric shapes found in the motif: the right triangle and the rectangle.

d. Tapak Kebo Motif

The Tapak Kebo (buffalo footprint) motif is applied to the lomar (headcloth) of the Baduy tribe, symbolizing diligence and the highly valued principles of the Baduy community in Lebak. (Suparti & Umam, 2023). The mathematical elements include the acute triangle and the rhombus. The repetition of acute triangles establishes sharp directional cues, emphasizing diligence and strength. The rhombus units form rotational arrays, implying cyclical movement associated with agricultural rituals and community solidarity. The overall illustration of the Tapak Kebo motif is presented in Figure 8 below:

Figure 8 displays the Tapak Kebo motif, which contains the geometric concepts of the acute triangle and the rhombus. Stylized floral ornaments, large leaf patterns, and decorative curved tendrils further enrich the design.

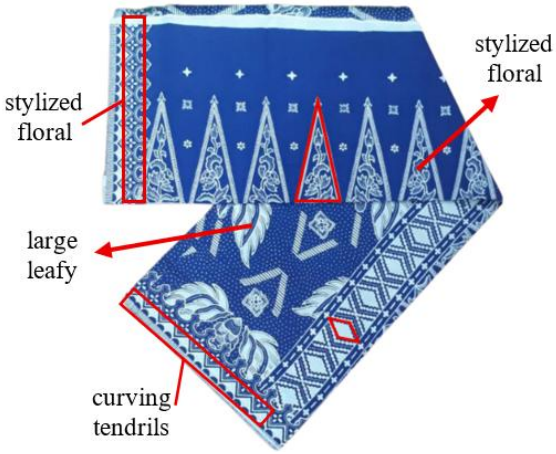

Figure 8. Tapak Kebo Motif

The core geometric shapes identified within the Tapak Kebo Motif are shown in Figure 9 below:

Figure 9. Acute Triangle & Rhombus

Figure 9 highlights the fundamental geometric shapes found in the motif: the acute triangle and the rhombus.

e. Tari Rampak Bedug Motif

Tari Rampak Bedug Motif is a batik motif from Pandeglang batik. In the motif, there is a picture of the rampak bedug tari, and the bedug musical instrument. The Bedug musical instrument is made of wood and cow or buffalo skin, which is used to indicate prayer times for Muslims and is used as a property in the tari rampak bedug. Being beaten with sticks made of wood makes a sound (Solihin & Pujiastuti, 2023). The circle dominates this motif, serving as a representation of the drum and acting as a geometric center. The motif exhibits circular symmetry and rotational patterns, both of which reflect the coordinated, rhythmic movements of the Rampak Bedug performance. The recurring circular forms symbolize communal unity and synchronized collective expression. The overall illustration of the Tari Rampak Bedug Motif is presented in Figure 10 below:

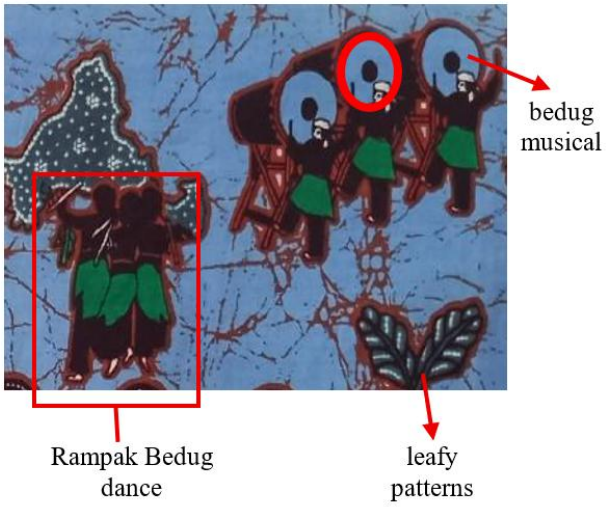

Figure 10. Tari Rampak Bedug Motif

Figure 10 displays the Tari Rampak Bedug motif from Pandeglang, which is dominated by the

mathematical concept of the circle. In addition to the geometric elements, the motif features the bedug musical instrument, dancers performing the Rampak Bedug, and leafy patterns.

The core geometric shapes identified in the Rampak Bedug Dance Motif are shown in Figure 11 below:

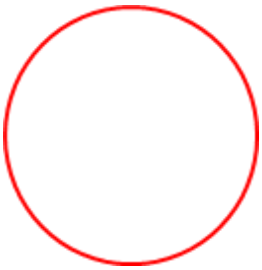

Figure 11. Circle

Figure 11 highlights the primary geometric shape, the circle, which serves as the central element for surrounding decorations and patterns.

f. Leuit Salisung Pare Sapocong motif

The Leuit Salisung Pare Sapocong motif is found in Cikadu Pandeglang batik. The characteristic of this cloth is that there are two motifs, namely Leuit (a barn used to store agricultural rice) and lisung, halu and rice contain symbols of fertility (Hanafi & Mutaqin, 2022). The motif incorporates the trapezoid, square, rectangle, and triangle. Trapezoids resemble the barn roofs, while squares and rectangles mimic the structure of the rice storage units. This geometric arrangement reflects agricultural logic, such as balance, support, and stability. The overall illustration of the Leuit Salisung Pare Sapocong Motif is presented in Figure 12 below:

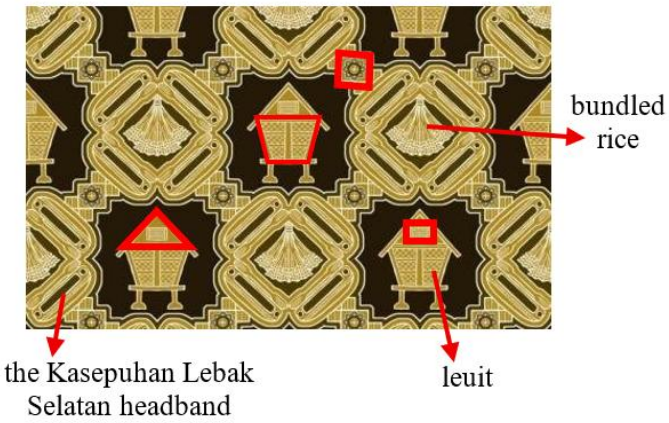

Figure 12. Leuit Salisung Pare Sapocong Motif

Figure 12 displays the Leuit Salisung Pare Sapocong motif, which contains the geometric concepts of the trapezoid, square, rectangle, and triangle. The design features bundled rice (sapocong), complemented by the leuit ornament and the Kasepuhan Lebak Selatan headband.

The core geometric shapes identified in the Leuit Salisung Pare Sapocong Motif are shown in Figure 13 below:

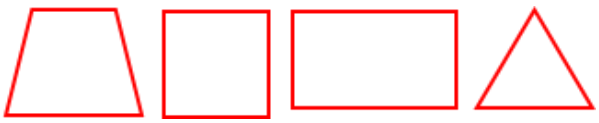

Figure 13. Trapezoid, Square, Rectangle, and Triangle

Figure 13 highlights the fundamental geometric shapes found in the motif: the trapezoid, square, rectangle, and triangle.

g. Kue Gipang Motif

The Kue Gipang motif is found in Krakatoa batik, which is a typical Cilegon batik. Kue Gipang motif comes from a typical food for the people of Cilegon Banten during Eid al-Fitr (Syam & Pujiastuti, 2023). The mathematical concepts involve the combination of the rectangle and the rhombus (or kite shape), which form interlocking patterns resembling the gipang cake blocks. The kite shapes create diagonal orientations that demonstrate reflection and rotation. Simultaneously, wave-like patterns symbolize the marine mythology associated with Krakatau. The overall illustration of the Kue Gipang Motif is presented in Figure 14 below:

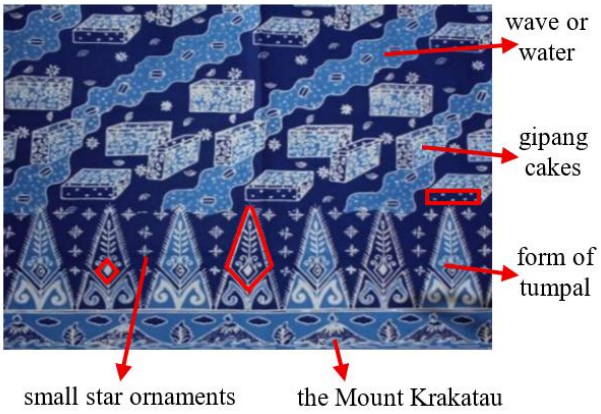

Figure 14. Kue Gipang Motif

Figure 14 displays the Kue Gipang motif, which applies the geometric concepts of the kite, rectangle, and rhombus. The design features rectangular blocks symbolizing the traditional gipang cake, combined with Mount Krakatau patterns in the form of a tumpal, wave patterns, and small star ornaments.

The core geometric shapes identified in the Kue Gipang Motif are shown in Figure 15 below:

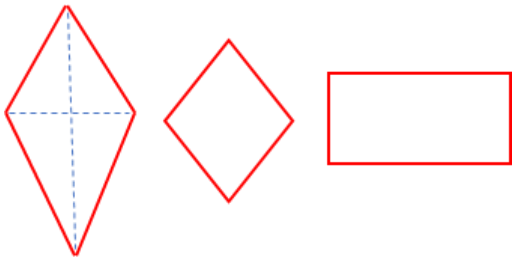

Figure 15. Kite, Rhombus, and Rectangle

Figure 15 highlights the key geometric shapes found in the motif: the kite, rhombus, and rectangle, which are arranged to form interlocking patterns.

3.2 Discussion

The purpose of this research was to explore ethnomathematical elements embedded in typical Banten batik motifs by analyzing geometric structures present within the patterns and interpreting their cultural meaning. The findings indicate that the seven motifs examined, namely Kapurban, Tambakbaya, Kalimaya, Tapak Kebo, Tari Rampak Bedug, Leuit Salisung Pare Sapocong, and Kue Gipang, contain a diverse range of plane shapes. These include squares, rectangles, rhombuses, right triangles, acute triangles, trapezoids, circles, and kites. The presence of these geometric forms demonstrates that batik is not merely a decorative cultural artifact but a representation of mathematical reasoning that emerges naturally through cultural practice.

The following is an explanation of each geometric shape contained in the typical Banten batik motif. A square is a flat shape that is bounded by four sides of equal length and has the same parallel sides and has four right angles (Yuningsih et al., 2021). A rectangle is a quadrilateral flat shape whose parallel sides are the same length and all of its angles are right angles, namely angles of ninety degrees

(Janan, 2022). A rhombus is a two-dimensional flat shape formed by four congruent right triangles, with opposite angles of equal size (Heriyati & Handayani, 2022). A circle is a set of points on a flat plane that have the same distance from a fixed point on the plane (Juhaeni et al., 2022). A right triangle is a triangle that has a right angle of ninety degrees (Handayani, 2016). An acute triangle is a triangle whose three angles have sizes between zero degrees and ninety degrees (Laukum et al., 2024). A trapezoid is a rectangular shape that has exactly one pair of parallel opposite sides (Yuningsih et al., 2021). A kite is a quadrilateral that has exactly one pair of opposite angles of equal size and one pair of adjacent sides of equal length (Naja et al., 2021).

Beyond listing their appearance, the geometric elements identified in each motif reveal deeper mathematical structures. Many motifs demonstrate reflectional symmetry, rotational symmetry, translational repetition, proportionality, and tiling patterns. These mathematical characteristics reflect cultural logic rather than randomness. For example, the Kapurban motif employs balanced arrangements of squares and rhombuses that visually resemble grid-based tiling, symbolizing the values of sincerity and steadfastness attributed to Prince Purba. The Tambakbaya motif uses repeated rhombuses arranged through translational symmetry, representing rhythm and continuity associated with palace guards. The Kalimaya motif imitates the faceted structure of the Kalimaya gemstone using triangular tiling, while the Tapak Kebo motif expresses directional strength through repeated acute triangles. These patterns suggest that geometry in batik emerges from a cultural understanding of order, movement, stability, and symbolism.

The geometric regularity found in the motifs also aligns with ethnomathematical theory. Rosa and Orey (2020) emphasize that ethnomathematics emerges from cultural practices and reflects how communities categorize, measure, design, and interpret their environment through culturally embedded mathematical reasoning. The structural logic found in Banten batik motifs illustrates how artisans intuitively apply mathematical concepts grounded in cultural meaning. Bishop also states that mathematical ideas originate from human activities and cultural expressions (Yolanda & Putra, 2022). In the Banten context, the integration of repetitive shapes, symmetry, and proportional designs demonstrates the society's spatial reasoning, shaped by its heritage, environmental context, and ritual traditions.

Comparison with previous research further strengthens these interpretations. Safira et al. (2021) and Syari et al. (2022) confirm the presence of squares, rectangles, and rhombuses in Kapurban and Tambakbaya motifs. These findings are consistent with the present study. However, in the Kalimaya motif, the present research identifies right triangles and rectangles, which contrasts with Subekhi et al. (2021), who found circles and rhombuses. This discrepancy highlights that batik motifs may vary across production centers, artistic interpretations, or design evolution. The Tapak Kebo motif contributes new insights because no prior research has examined its geometric structure. These comparisons show that the present study advances existing knowledge by adding deeper structural analysis and identifying transformation patterns that were not previously discussed.

From a cognitive perspective, the mathematical structures in batik support the formation of abstract geometric understanding. According to Piagetian theory, concrete visual experience plays a crucial role in helping learners build mental models of shapes, space, and transformation. The symmetry, repetition, and tiling present in the motifs can strengthen students' visual-spatial reasoning and pattern recognition skills. The cultural grounding of these patterns can also improve motivation and meaningful learning, as students are more likely to engage with mathematics when it is presented through familiar cultural contexts.

In terms of educational implications, the motifs offer strong potential for use in teaching geometry in accordance with the Independent Curriculum. Teachers can employ the motifs for classroom activities such as identifying shapes, analyzing symmetry, measuring area and perimeter, comparing proportional relationships, exploring geometric transformation, and generalizing patterns. The motifs can be integrated into LKPD or project-based tasks where students recreate patterns, identify mathematical rules, or design culturally inspired geometric compositions. This approach can

produce outcomes that are both cognitive and cultural, improving students' mathematical understanding while strengthening their identity and appreciation for local culture.

Despite its contributions, the study has some limitations. Only seven motifs were analyzed, so the findings do not represent the entire diversity of Banten batik. Future research may expand the selection of motifs, combine anthropological interviews with mathematical reconstruction, or apply digital image analysis to measure geometric properties more precisely. An interdisciplinary approach that involves anthropology, ethnology, design, and mathematics education can deepen the interpretation of pattern structures and broaden insights into cultural mathematical cognition.

Overall, the discussion shows that Banten batik motifs contain integrated mathematical structures that reflect cultural values and spatial reasoning within the community. The study contributes a new understanding by connecting geometric analysis with cultural logic and educational application. These findings support the development of more contextual, meaningful, and culturally responsive mathematics learning in Indonesia.

4. Conclusion

This study successfully achieved its aim of exploring and analyzing the plane shape concepts embedded in typical Banten batik motifs. The examination of seven motifs, Kapurban, Tambakbaya, Kalimaya, Tapak Kebo, Tari Rampak Bedug, Leuit Salisung Pare Sapocong, and Kue Gipang revealed the presence of geometric forms such as squares, rectangles, rhombuses, triangles, trapezoids, circles, and kites. These findings demonstrate that cultural artifacts that are visually aesthetic also contain structured mathematical representations that develop naturally within the visual traditions of the Banten community.

The analysis of regularity, symmetry, repetition, and geometric composition within the motifs shows that intuitive geometric reasoning is embedded in the creative processes of the artisans. The recurring patterns, balanced arrangements, and presence of reflective and rotational symmetry indicate that mathematical principles are applied implicitly in batik craftsmanship. Cognitive development theory also emphasizes the importance of concrete cultural experiences in supporting the development of abstract reasoning.

From an educational perspective, this research formulates the potential of Banten batik motifs as contextual and culturally grounded media for mathematics learning. The motifs provide meaningful opportunities for teachers to introduce plane shapes, analyze geometric properties, and explore patterns and symmetry through authentic contexts familiar to students. Such integration supports the development of relevant, engaging, and culturally responsive learning experiences while fostering appreciation for local heritage.

Theoretically, this study contributes a structured geometric classification model for Banten batik motifs and expands the ethnomathematics literature through a visual and structural analytical approach. Practically, it offers a framework that can be utilized in the development of learning materials such as worksheets, instructional modules, or digital resources that incorporate batik contexts into geometry instruction. Nonetheless, this research acknowledges its limitations, particularly the limited number of motifs examined and the disciplinary focus centered primarily on mathematics. Future studies involving a wider range of motifs and interdisciplinary collaboration across mathematics, anthropology, art, and cultural studies would enrich the findings and strengthen their applicability.

Overall, this research provides an important contribution to the advancement of ethnomathematics in Indonesia and supports the integration of cultural knowledge into educational practices. The results affirm that geometric concepts are not confined to formal instruction but are vividly present in cultural expressions passed down through generations in the Banten community.

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