

## EXPLORING FRIEZE PATTERNS IN *LOTIS* AMANUBAN WOVEN FABRICS: INTEGRATION OF *TEKE* AND *BIKLUSU* MOTIFS INTO MATHEMATICS EDUCATION

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### Abstract

The teke (gecko) and biklusu (lizard) motifs in lotis woven fabrics represent symbolic and spiritual values in Amanuban culture while also containing mathematical structures. However, these mathematical aspects are rarely explored, and local weaving traditions are seldom integrated into formal mathematics learning. This gap has led to limited use of cultural resources in supporting students' understanding of geometry. Therefore, this study identifies the types of frieze patterns in three variants of these motifs and explores their potential for integration into mathematics education. A descriptive qualitative approach was employed, utilizing direct observation, documentation, and interviews with weavers and cultural elders. The primary data consisted of visual representations of the three motifs, which were analyzed through isometric transformations including translation, vertical and horizontal reflection, 180° rotation, and glide reflection. The classification was based on the seven types of frieze patterns as defined by the one-dimensional isometry group theory. The findings reveal that two motifs correspond to the F6 frieze pattern type, while one aligns with the F7 type, demonstrating varying degrees of geometric symmetry complexity. The *teke* and *biklusu* motifs can serve as effective contextual tools for mathematics instruction across educational levels, from pattern recognition in primary school to advanced discussions of isometry group theory in higher education. This approach aligns with the goals of the Merdeka Curriculum by linking mathematics learning to meaningful local contexts.

**Keywords:** *Biklusu*; contextual learning; frieze patterns; *lotis* woven fabrics; *teke*.

### Abstrak

Motif teke (tokek) dan biklusu (cecak) pada kain tenun lotis merepresentasikan nilai simbolik dan spiritual dalam budaya Amanuban sekaligus mengandung struktur matematis. Namun, aspek matematis ini jarang dikaji, dan tradisi tenun lokal belum banyak diintegrasikan ke dalam pembelajaran matematika formal. Kondisi ini menyebabkan potensi budaya sebagai sumber belajar kurang dimanfaatkan untuk mendukung pemahaman geometri siswa. Oleh karena itu, penelitian ini bertujuan mengidentifikasi jenis frieze pattern pada tiga variasi motif tersebut serta mengkaji urgensi integrasinya dalam pembelajaran matematika. Penelitian ini menggunakan metode kualitatif deskriptif dengan teknik pengumpulan data berupa observasi langsung, dokumentasi dan wawancara terhadap penenun dan tokoh adat. Data utama berupa visual dari tiga motif teke dan biklusu tenun lotis yang dianalisis melalui pengamatan struktur isometri yang meliputi translasi, refleksi vertikal dan horizontal, rotasi 180°, serta glide reflection. Kriteria klasifikasi mengikuti tujuh pola frieze berdasarkan teori grup isometri satu dimensi. Hasil penelitian menunjukkan bahwa dua motif termasuk frieze pattern tipe F6 dan satu motif tergolong F7 yang masing-masing mencerminkan tingkat kompleksitas simetri geometris berbeda. Motif teke dan biklusu dapat digunakan sebagai media pembelajaran matematika kontekstual yang efektif pada setiap jenjang pendidikan mulai dari pengenalan pola di Sekolah Dasar hingga kajian teori grup isometri di perguruan tinggi. Pendekatan ini mendukung tujuan Kurikulum Merdeka dengan mengaitkan pembelajaran matematika pada konteks lokal yang bermakna.

**Kata kunci:** *Biklusu*; pembelajaran kontekstual; pola frieze; tenun lotis; *teke*.



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## INTRODUCTION

Mathematics, as a human endeavor, evolves from practical activities such as counting and measuring into an abstract discipline for identifying patterns and relationships. However, in formal education, mathematics is often presented in decontextualized and formal ways, which limits students' ability to relate mathematical ideas to their lived experiences (Niss & Højgaard, 2019; OECD, 2018). To foster meaningful learning, mathematics education should be contextualized and rooted in culture.

Ethnomathematics provides a relevant approach to linking mathematical reasoning with cultural practices (Prahmana & D'Ambrosio, 2020). Cultural artifacts such as woven fabrics embody mathematical thinking through symmetry, repetition, and geometric composition. Several recent studies have explored the mathematical structures embedded in Indonesian weaving traditions. Indriati et al. (2022) identified frieze and wallpaper symmetries in Siak motifs, while Radiusman and Juniati (2022) found geometric transformations in Lombok weaving that can support geometry instruction. Merdja and Restianim (2022) examined geometric patterns in Ende Lio woven motifs and showed their potential for contextual mathematics learning, and Sari et al. (2024) highlighted the potential of woven textiles as meaningful contexts for geometry learning. These studies demonstrate the pedagogical potential of traditional crafts as contextual media for mathematics education.

Despite these advances, Amanuban lotis weaving, a traditional craft of the Dawan community in South Central Timor Regency, has not been systematically examined from a

mathematical perspective. Lotis weaving employs a supplementary weft technique, where colored cotton or metallic threads are inserted into the base fabric to create intricate motifs. This traditional technique has been documented as part of East Nusa Tenggara's intangible cultural heritage (UPTD Museum Daerah Propinsi Nusa Tenggara Timur, 2005) and continues to be practiced as a marker of ethnic identity and ritual significance in contemporary society (Dominikus et al., 2023)). Among its most iconic designs are the *teke* (gecko) and *biklusu* (lizard) motifs, which symbolize purity and honesty in Amanuban cultural philosophy. These motifs exhibit visual regularities and geometric repetition that suggest the presence of frieze pattern structures.

However, their mathematical potential has not been explored within the framework of isometric transformation and frieze pattern classification, representing a clear research gap in ethnomathematical studies of East Nusa Tenggara weaving. The underuse of local cultural resources in mathematics instruction also limits students' exposure to meaningful, culturally embedded examples of geometry. Addressing this issue aligns with the vision of the Merdeka Curriculum, which emphasizes contextual, creative, and culture-based learning (Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, 2024).

This study seeks to identify and classify the types of frieze patterns found in the *teke* and *biklusu* motifs of Amanuban lotis woven fabrics based on one-dimensional isometry group theory, and to explore their pedagogical relevance for mathematics education,

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particularly in teaching geometric transformations. The results are expected to enrich contextual mathematics learning, bridge the gap between culture and geometry, and strengthen students' appreciation for Indonesia's mathematical heritage.

**METHODS**

This study adopts a descriptive qualitative approach, focusing on identifying the mathematical structures embedded in the *teke* and *biklusu* motifs of Amanuban *lotis* weaving, specifically their classification as frieze patterns, and examining their potential for integration into mathematics education.

The research was conducted in Amanuban, South Central Timor Regency, East Nusa Tenggara Province, a region known as the origin of *lotis* weaving artisans. Data were collected using three techniques: direct observation of the weaving process and the finished woven fabrics, visual documentation through photographs and videos, and semi-structured interviews with local weavers and cultural figures.

The research procedure followed several steps. First, direct observations were conducted to document the weaving process and identify the motifs produced. Second, visual data were compiled through photographs and videos of the *teke* and *biklusu* motifs. Third, semi-structured interviews with weavers and cultural figures were carried out to obtain additional insights into the cultural significance of the motifs. Finally, the collected visual data were analyzed to classify the motifs according to the seven frieze group patterns.

Data analysis was carried out in two stages. First, each *teke* and *biklusu* motif was analyzed to identify the type of frieze pattern it represents, based on

the seven frieze group classifications (F1-F7) as outlined by Umble and Han (2014). The first pattern, F1, is the simplest, characterized solely by translation without any reflection or rotation, resulting in a one-directional repetition. F2 consists of translation combined with glide reflection, creating a mirrored shift along a horizontal axis. F3 includes translation and vertical reflection, where each unit is the mirror image of the adjacent unit along a vertical axis. F4 combines translation and 180° rotation. F5 features translation, 180° rotation, and vertical reflection, creating a configuration where motifs rotate and align symmetrically. Interestingly, vertical reflection in F5 can also be derived by combining glide reflection and 180° rotation, illustrating the interconnectedness of symmetrical elements. F6 is composed of translation and horizontal reflection, where motif elements are symmetrical along a horizontal line. Finally, F7 is the most complex and symmetrical type, incorporating translation, vertical and horizontal reflection, and 180° rotation, resulting in a highly balanced pattern in both horizontal and vertical directions. All seven frieze types are illustrated in Figure 1.

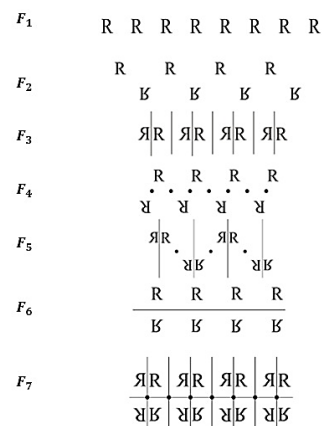


Figure 1. The seven frieze group patterns as classified by Umble and Han (2014)

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The identification of frieze pattern types was carried out by visually analyzing all existing motifs to determine whether they exhibited unidirectional translation and were constructed using other isometric transformations. These transformations may include horizontal reflection, vertical reflection, 180° rotation, or glide reflection. Based on this analysis, the specific frieze group present in each woven pattern could be determined (Indriati et al., 2022). The results of this identification were analyzed to assess their pedagogical potential for teaching geometric transformations at various educational levels.

## RESULTS AND DISCUSSION

The decorative motifs of geckos and lizards, locally referred to as *teke* or *biklusu*, represent the lived experiences of Timorese communities. In ancient times, their ancestors dwelled in caves where these animals were frequently observed crawling along the walls. Among the *Dawan* people, geckos and lizards symbolize purity and honesty. It

is believed that when a lizard makes a sound during a conversation involving a promise or a truthful statement, it affirms the speaker's words. Additionally, the lizard is considered a spiritual intermediary between the living and the ancestral spirits. The gecko is often regarded as a harbinger of future events. Both animals are honored as sacred symbols of the Earth's deity.

Among the various decorative patterns found in the South Central Timor region, motifs of this type are especially prominent in the weaving traditions of Amanatun, Amanuban, and Mollo. Historically, these woven fabrics were reserved for the nobility (*usif*), although they are now worn by all community members (UPTD Museum Daerah Propinsi Nusa Tenggara Timur, 2005).

The actual forms and colors of *teke* and *biklusu* motifs vary significantly, shaped by each weaver's creativity and artistic interpretation rather than by standardized templates. This variation is illustrated in Figure 2.

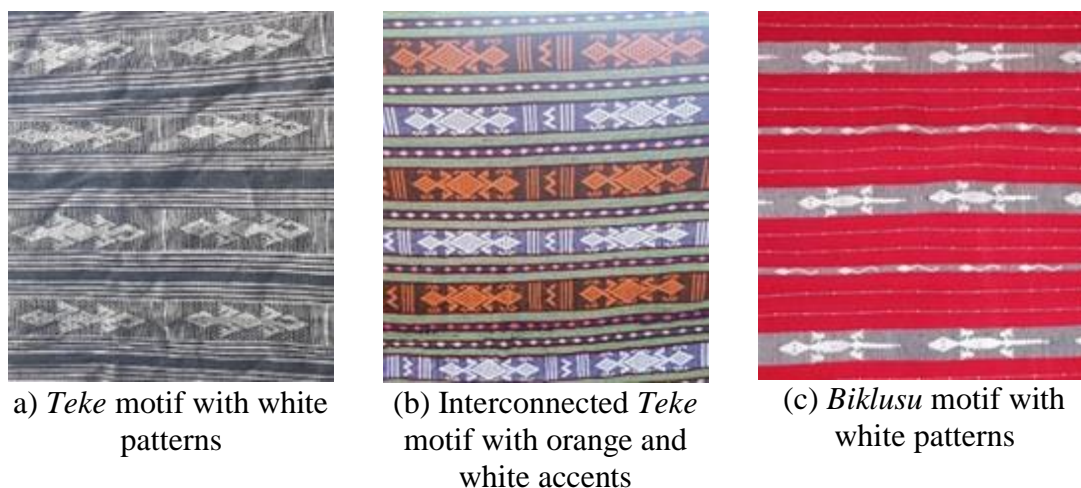


Figure 2. *Teke* and *Biklusu* Motifs (source: research documentation)

This study analyzes three variants of *lotis* woven fabrics, each featuring distinct *teke* and *biklusu* motifs (Figure 2), to identify the types of frieze

patterns they exhibit. The white *teke* motif shown in Figure 2(a) is a stylized representation of a gecko, repeated horizontally as a fundamental part of the

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design. In the cultural context of East Nusa Tenggara, the gecko is often viewed as a guardian of the home. Therefore, its appearance in woven fabrics serves not only an ornamental function but also carries symbolic meaning. Visually, the *teke* motif is characterized by an elongated body, laterally extended legs, and a curved tail, all of which facilitate geometric transformation analysis.

Mathematically, this motif illustrates a frieze pattern, which refers to a two-dimensional design that exhibits infinite repetition in a horizontal direction. The first type of isometric transformation identified in this motif is translation, marked by the consistent and parallel repetition of the basic design consisting of two geckos with tails curving downward and upward, extending from left to right without any change in orientation or shape, as illustrated in Figure 3.

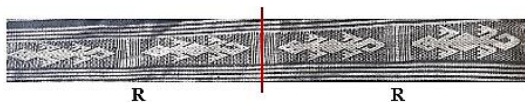


Figure 3. Translation in the White-Patterned *Teke* Motif

Furthermore, the presence of horizontal reflection is discernible in the mirrored arrangement of the gecko's dorsal and ventral sides, most notably in the curvature of the tail, as illustrated in Figure 4.



Figure 4. Horizontal Reflection in the White-Patterned *Teke* Motif

However, vertical reflection is absent, since the left and right sides of each gecko are not symmetrical. Likewise, there is no 180° rotation, as all geckos face the same direction and are not arranged in back-to-back positions. A glide reflection is also not present, as there is no combination of reflection and translation in the motif. Given that only translation and horizontal reflection are present, this motif is classified as a Type F6 frieze pattern.

The motif in Figure 2(b) displays a horizontally repeated arrangement of geckos in alternating orange and white bands, positioned alongside other decorative elements. The geckos are depicted with extended bodies and spread limbs, with heads and tails oriented in opposite directions. In cultural terms, the motif retains its symbolic role as a protective element, representing beliefs in balance and protection from harm.

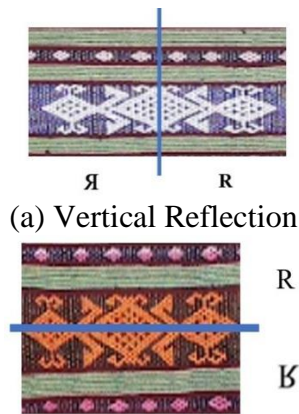
From a mathematical perspective, the motif exhibits a clear frieze pattern characterized by translational symmetry, as illustrated in the consistent repetition of the basic unit throughout the pattern (refer to Figure 5).



Figure 5. Translation in the Interconnected *Teke* Motif with Orange and White Accents

Vertical reflection is visible, as the left and right sides of each gecko mirror each other across a central vertical axis. Horizontal reflection is also present, given the mirrored top and bottom halves of the gecko motif as shown in Figure 6.

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(a) Vertical Reflection



(b) Horizontal Reflection

Figure 6. Reflection on the Interconnected *Teke* Motif with Orange and White Accents

Furthermore,  $180^\circ$  rotation occurs, as pairs of geckos are positioned back-to-back. A  $180^\circ$  rotation about the midpoint between these geckos aligns one with the other as shown in Figure 7. Despite this complexity, glide reflection is not observed.

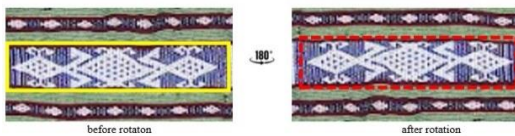


Figure 7. Rotation in the Interconnected *Teke* Motif with Orange and White Accents

With four symmetries present (translation, vertical and horizontal reflection, and rotation), this motif is identified as a Type F7 frieze pattern, the most symmetrical classification among the seven frieze types.

Figure 2(c) presents a motif featuring a small lizard-like figure (*biklusu*), traditionally used in woven fabrics from East Nusa Tenggara. The *biklusu* has a simpler form than the gecko, with a rounded head and symmetrically extended legs. Repeated horizontally on a red band with gray stripes, the motif forms a strong frieze structure. Culturally, the *biklusu*

symbolizes resilience, agility, and adaptability, all of which enrich its philosophical significance in traditional woven fabrics.

Mathematically, the motif clearly exhibits translation, with uniform repetition in one direction as shown in Figure 8.

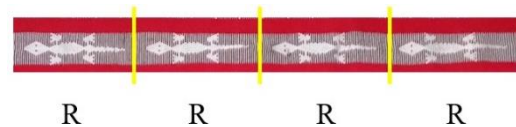


Figure 8. Translation in the *Biklusu* motif with white patterns

Horizontal reflection is also prominent; the top and bottom halves of the *biklusu* are mirrored along a central horizontal axis as shown in Figure 9.



Figure 9. Horizontal reflection in the *Biklusu* motif with white patterns

However, vertical reflection is not present, as the left and right sides are neither identical nor mirrored. There is also no  $180^\circ$  rotation, as all figures face the same direction. Similarly, glide reflection does not occur. With only translation and horizontal reflection, this motif also falls under the Type F6 frieze pattern. Despite its simplicity, it displays a visually harmonious structure that holds educational value in contextual mathematics learning.

These three motifs (two *teke*-based and one *biklusu*-based) demonstrate that traditional weaving designs

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contain not only cultural and aesthetic value but also exhibit clear mathematical structures consistent with frieze pattern principles. Each motif presents specific geometric transformations that correspond to the seven types of one-dimensional isometry classifications. Similar findings were reported by Indriati et al. (2022), who revealed that traditional woven fabrics also embody geometric transformations and symmetry concepts, including frieze patterns, thereby establishing meaningful connections between cultural expressions and mathematical ideas.

The first *teke* and *biklusu* motifs both reflect simpler structures that involve translation and horizontal reflection, corresponding to Type F6. In contrast, the second *teke* motif exhibits the most complex symmetry structure, combining translation, vertical and horizontal reflection, and  $180^\circ$  rotation. These elements classify it as a Type F7 frieze pattern, recognized as the most symmetrical of the seven types. These designs nonetheless reveal a strong sense of symmetry and balance. Although relatively simple, they reflect how traditional cultural expressions may embody geometric principles such as symmetry and repetition, regardless of whether they are consciously intended, as highlighted in contemporary ethnomathematics research that views cultural artifacts as meaningful representations of mathematical ideas (Prahmana & D'Ambrosio, 2020; Wulandari et al., 2024).

Pattern plays a central role in both design aesthetics and mathematics, as geometric motifs in cultural artifacts reflect mathematical thinking, even among artisans without formal education in mathematics. The patterns in woven crafts reflect mathematical thinking rooted in traditional knowledge

passed down through generations, representing unique local skills developed within specific indigenous communities for everyday practical use (Laurens et al., 2021). These findings align with the goals of the Merdeka Curriculum, which promotes culturally contextualized learning. The varying degrees of isometric complexity in the three motifs offer transformative opportunities for teaching geometry. By using frieze patterns from *lotis* Amanuban woven fabrics, educators can create learning activities that connect mathematical content with cultural heritage.

This perspective is consistent with ethnomathematics, which emphasizes cultural practices as meaningful contexts for mathematical exploration (Prahmana & D'Ambrosio, 2020; Wulandari et al., 2024). Ethnomathematics serves as a bridge between abstract mathematical concepts and students' lived cultural experiences, making mathematics learning more accessible and contextually meaningful (Fouze & Amit, 2017; Purniati & Suhaedi, 2025).

Moreover, identifying frieze patterns in traditional motifs can support the incorporation of local textiles into math education. Integrating mathematics instruction with local culture, as demonstrated through the *lotis* Amanuban motifs, not only facilitates conceptual understanding but also fosters cultural resonance in the classroom. The identification of symmetry and transformation in these traditional designs supports the notion that mathematics can emerge organically from students' own cultural environments. Weaving fosters interdisciplinary learning by integrating mathematics, science, sustainability, and character development, while offering

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students cultural insight and practical skills for the future through hands-on engagement and historical understanding (Balabuch & Rasoarifetra, 2023). Weaving activities can serve as meaningful contexts and resources for mathematics learning, enabling students to understand mathematical concepts more concretely and encouraging educators to integrate local cultural practices into instruction (Dominikus et al., 2023; Siregar & Rakhmawati, 2023). As a context, the results of the analysis of woven motifs could be used as content for mathematical exploration and technological literacy in the learning process (Sulistyawati & Radite, 2022).

Through the lens of frieze patterns, the three *teke* and *biklusu* motifs offer valuable opportunities for integrating mathematics learning across all phases of elementary education. At this level, the first gecko motif, which features translational and horizontal reflection symmetries serves as an accessible entry point for introducing basic geometric concepts such as repetition and symmetry.

After observing *teke* and *biklusu* motif and discussing its repeating structure, students engage with tailored worksheets designed to deepen their understanding through hands-on activities. In Phase A (Grades 1-2), children may complete a coloring activity in which they continue a sequence of gecko motifs using a simple three-color pattern. This reinforces their recognition of visual repetition and supports fine motor development through coloring tasks.

In Phase B (Grades 3-4), worksheets challenge students to extend partially drawn motif strips and describe the pattern using their own words. This phase encourages active rule discovery,

helping learners internalize concepts of regularity and orientation within a repeating design.

By Phase C (Grades 5-6), students work with more complex worksheets requiring them to identify and categorize the transformations found within the motif, such as translation or horizontal reflection. They might also be asked to compare different frieze types, developing spatial reasoning and early classification skills.

Across all phases, these structured worksheet activities, introduced after guided visual exploration, foster the development of mathematical thinking through culturally rooted content. This progression aligns with constructivist traditions rooted in Piaget's work, as critically revisited in contemporary scholarship (Lourenço, 2016), which emphasizes the role of real-world, interactive experiences in building children's conceptual understanding. Furthermore, by embedding cultural heritage in mathematics instruction, students experience learning as both cognitively meaningful and personally relevant.

In junior high school (Fase D of the Merdeka Curriculum), the second gecko motif, featuring both translation and vertical reflection offers meaningful opportunities to explore geometric transformations at a deeper level. After observing the motif, students can be guided to distinguish between horizontal and vertical reflections and identify how the shapes are repeated across a strip. Through these activities, learners develop spatial awareness and begin to describe transformations informally, using everyday language and diagrammatic representations rather than symbolic notation.

For instance, students can be asked to sketch the gecko motif on grid paper and continue the pattern based on

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their observations. They can mark the line of reflection, indicate the direction of repetition, and discuss whether the gecko figures flip or shift. These tasks help students recognize the characteristics of reflection and translation in a visual and concrete way, aligning with the expected competencies for transformation geometry at this level.

To support deeper understanding, the activity can be conducted in pairs or small groups, where students compare patterns, articulate their thinking, and revise their conclusions based on peer input. This collaborative learning process reflects Lev Vygotsky's concept of the Zone of Proximal Development (ZPD), where cognitive growth occurs through interaction with more knowledgeable peers or teachers. Recent research by Kamid et al. (2023) shows that a ZPD-based technological learning environment in mathematics supports computational thinking and collaborative reasoning, aligning with the goals of contextual and culture-based learning. Through this culturally grounded exploration, students not only develop foundational geometric reasoning but also cultivate an appreciation for the mathematical richness within traditional motifs.

At the senior high school level (Fase E of the Merdeka Curriculum), the third gecko motif characterized by the presence of translation, horizontal and vertical reflections, as well as  $180^\circ$  rotation serves as a rich medium for deeper exploration of geometric transformations. After analyzing the motif, students are encouraged to identify and describe the sequence of transformations that occur along the strip. This leads to the construction of transformation tables, where each instance of the motif is matched with the type of transformation it undergoes.

Students can then be guided to compare the three motifs systematically and classify the third motif under the F7 category within the frieze pattern classification. This classification task not only enhances their understanding of the composition of transformations and symmetry but also sharpens their ability to reason deductively and recognize underlying mathematical structures.

To further engage students, the learning process can involve structured group discussions, visual modeling using digital tools or manipulatives, and the presentation of their analysis through posters or multimedia formats. These activities support the development of higher-order thinking skills such as analysis, evaluation, and abstraction which are key competencies in Fase E. Moreover, framing these explorations within the cultural context of Timorese weaving helps students see mathematics not just as a theoretical subject, but as a tool for understanding and appreciating cultural heritage. This culturally responsive approach reinforces the relevance and interconnectedness of mathematical ideas in real-world contexts.

At the university level, particularly within mathematics education and ethnomathematics programs, the analysis of the three motifs provides a robust framework for exploring abstract mathematical structures such as the group of isometries. Students are guided to identify the types of transformations present in each motif and formalize them using mathematical notation, such as ordered pairs for translations and matrix representations for reflections and rotations. These activities enable learners to analyze how these transformations combine, forming closed systems that can be modeled through group theory.

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The learning approach based on the teke and biklusu motifs is highly relevant to ethnomathematics, which emphasizes the integration of cultural contexts into mathematics education to bridge the gap between formal mathematical concepts and mathematical ideas embedded in everyday life (Prahmana & D'Ambrosio, 2020; Wulandari et al., 2024). Several studies support this approach. For instance, Fouze & Amit (2017) demonstrated that incorporating culturally grounded activities in mathematics instruction helps students understand mathematical concepts through familiar cultural contexts. Purniati & Suhaedi (2025) further showed that integrating visual patterns derived from cultural motifs promotes students' understanding of geometric transformations and mathematical thinking. These findings are reinforced by Roza et al. (2024), who designed geometry teaching materials using Malay batik patterns on the topic of geometric transformations, demonstrating that culturally grounded motifs can effectively strengthen students' conceptual understanding of symmetry and transformation. Indriati et al. (2022) also concluded that frieze patterns can serve as effective tools for enhancing students' mathematical literacy through culturally grounded approaches. Merdja & Restianim (2022) found that traditional woven motifs from Ende Lio contain geometric elements and transformation patterns that can be utilized as contextual resources for learning geometry, strengthening the pedagogical connection between cultural identity and mathematical understanding. Radiusman & Juniati (2022) also concluded that using teaching aids such as Lombok woven fabrics to teach geometric patterns enables students to better recognize

their cultural heritage and to see the strong relationship between culture and mathematics, making classroom geometry lessons more engaging.

In summary, the *teke* and *biklusu* motifs analyzed in this study highlight the intersection of mathematical reasoning and cultural heritage. These patterns not only support the understanding of geometric transformations but also promote cultural appreciation and contextualize mathematics as a meaningful and relevant discipline. Learning mathematics will be more meaningful if teachers are able to involve students' culture in constructing their knowledge in the learning process (Isnaniah et al., 2023; Siregar & Rakhmawati, 2023; Sulistyawati & Radite, 2022). Educators are responsible for the learning process, which includes the development of curricula and learning strategies based on the integration of cultural elements and values, and particularly ethnomathematical games, in math instruction (Fouze & Amit, 2017). Mathematics is a vital part of human understanding, yet its educational role remains limited, requiring a broader and more inclusive approach to realize its full potential in diverse cultures and societies (Prahmana & D'Ambrosio, 2020).

## CONCLUSION AND SUGGESTION

Based on the analysis of three Amanuban lotis woven fabric motifs featuring geckos and lizards (*teke* and *biklusu*), it can be concluded that these designs exhibit distinct mathematical structures in the form of frieze patterns. Two motifs, the white gecko and the *biklusu*, demonstrate translation and horizontal reflection, classifying them as Type F6 frieze patterns. The orange and white gecko motif incorporates translation, vertical and horizontal

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reflection, and  $180^\circ$  rotation, qualifying it as a Type F7 frieze pattern. Thus, the study confirms that Amanuban lotis weaving contains systematic frieze symmetries that can be utilized as contextual resources for mathematics education.

Future research should expand the scope to include other traditional motifs across different regions of Indonesia, enabling a broader mapping of ethnomathematical structures. Further studies may also investigate how these patterns can be effectively implemented in classroom practice through lesson designs, teaching modules, or digital learning media. Collaborative research involving mathematics educators, curriculum developers, and local artisans is recommended to develop culturally grounded teaching materials that simultaneously strengthen mathematical understanding and cultural identity.

## REFERENCES

- Badan Standar, Kurikulum, dan Asesmen Pendidikan Kementerian Pendidikan, Kebudayaan, Riset, dan Teknologi, Pub. L. No. 032/H/KR/2024 (2024). [https://kurikulum.kemdikbud.go.id/file/1718471412\\_manage\\_file.pdf](https://kurikulum.kemdikbud.go.id/file/1718471412_manage_file.pdf)
- Balabuch, A., & Rasoarifetra, B. (2023). Why Weaving? Teaching Heritage, Mathematics, Science and the Self. *African Archaeological Review*, 40(3), 481–491. <https://doi.org/10.1007/s10437-023-09541-w>
- Dominikus, W. S., Udil, P. A., Nubatonis, O. E., & Blegur, I. K. S. (2023). Exploration of the weaving activities in Timor Island for mathematics learning. *Ethnomathematics Journal*, 4(1), 1–18. <https://doi.org/10.21831/ej.v4i1.58473>
- Fouze, A. Q., & Amit, M. (2017). Development of Mathematical Thinking through Integration of Ethnomathematic Folklore Game in Math Instruction. *EURASIA Journal of Mathematics, Science and Technology Education*, 14(2), 617–630. <https://doi.org/10.12973/ejmste/80626>
- Indriati, M., Turmudi, T., & Dahlan, J. A. (2022). Frieze Pattern on Siak Weaving Motifs and Their Implementation in Mathematics Learning. *JNPM (Jurnal Nasional Pendidikan Matematika)*, 6(4), 761. <https://doi.org/10.33603/jnpm.v6i4.7711>
- Isnaniah, I., Imamuddin, M., & Annisa, A. (2023). Ethnomathematics Study: Mathematical Concepts in Bima Weaving Motifs. *AL-ISHLAH: Jurnal Pendidikan*, 15(3). <https://doi.org/10.35445/alishlah.v15i3.3687>
- Kamid, K., Sutrisno, S., Kurniawan, D. A., Anwar, K., Triani, E., & Septi, S. E. (2023). ZPD Technological Learning Environment In Learning Computational Thinking Skill-Based Mathematics. *Jurnal Pedagogi Dan Pembelajaran*, 6(1), 73–81. <https://doi.org/10.23887/jp2.v6i1.57920>
- Laurens, T., Kempa, R., & Serpara, H. (2021). The Ethnomathematics of Tutuwaru Community in the Crafts of Koli Leaf Weaving. *Jurnal Pendidikan Matematika (Jupitek)*, 3(2), 71–80.

DOI: <https://doi.org/10.24127/ajpm.v14i4.12463>

- <https://doi.org/10.30598/jupitekvol3iss2pp71-80>
- Lourenço, O. M. (2016). Developmental stages, Piagetian stages in particular: A critical review. *New Ideas in Psychology*, 40, 123–137. <https://doi.org/10.1016/j.newideapsych.2015.08.002>
- Merdja, J., & Restianim, V. (2022). Kajian Etnomatematika pada Motif Tenun Ikat Ende Lio. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(1), 727–733. <https://doi.org/10.24127/ajpm.v11i1.4897>
- Niss, M., & Højgaard, T. (2019). Mathematical competencies revisited. *Educational Studies in Mathematics*, 102(1), 9–28. <https://doi.org/10.1007/s10649-019-09903-9>
- OECD. (2018). *The Future of Education and Skills: Education 2030*. OECD Publishing. <https://doi.org/10.1787/9789264305797-en>
- Prahmana, R. C. I., & D'Ambrosio, U. (2020). Learning Geometry And Values From Patterns: Ethnomathematics On The Batik Patterns Of Yogyakarta, Indonesia. *Journal on Mathematics Education*, 11(3), 439–456. <https://doi.org/10.22342/jme.11.3.12949.439-456>
- Purniati, T., & Suhaedi, D. (2025). Unveiling the Geometry of Culture: An Ethnomathematical Exploration of Transformation Geometry in Cimahi Batik Motifs. *Jurnal Pendidikan MIPA*, 26(4), 2518–2541. <https://doi.org/10.23960/jpmipa.v26i4.pp2518-2541>
- Radiusman, R., & Juniati, D. (2022). Kajian Etnomatematika Kain Tenun Lombok Berdasarkan Pola Geometri Wallpaper Dan Pola Geometri Frieze. *AKSIOMA: Jurnal Program Studi Pendidikan Matematika*, 11(3), 1909–1923. <https://doi.org/10.24127/ajpm.v11i3.5329>
- Roza, Y., Nurqolbi, L., Adnan, A., & Alawiyah, T. (2024). Designing Geometry Teaching Materials Using Malay Batik Patterns on The Topic of Geometric Transformation. *Jambura Journal of Mathematics Education*, 5(2), 83–95. <https://doi.org/10.37905/jmathedu.v5i2.25427>
- Sari, A., Putri, R. I. I., Zulkardi, & Prahmana, R. C. I. (2024). Ethnomathematics in Indonesian woven fabric: The promising context in learning geometry. *Mathematics Teaching-Research Journal*, 16(5), 157–185. <https://mtrj.commons.gc.cuny.edu/volume-16-n-5/>
- Siregar, I. M. W., & Rakhmawati, F. (2023). Ethnomathematics in Making Woven Fabrics in the Sipirok Community. *Indonesian Journal of Science and Mathematics Education*, 6(2), 268–181. <https://doi.org/10.24042/ijjsme.v6i2.17771>
- Sulistiyawati, E., & Radite, R. (2022). Ethnomathematics study of bamboo woven model in Yogyakarta based on Liki design matrix and its integration in mathematics learning. *JRAMathEdu (Journal of Research and Advances in Mathematics Education)*, 237–252. <https://doi.org/10.23917/jramathedu.v7i4.18170>

DOI: <https://doi.org/10.24127/ajpm.v14i4.12463>

Umble, R. N., & Han, Z. (2014).  
*Transformational Plane Geometry*.  
CRC Press.

UPTD Museum Daerah Propinsi Nusa  
Tenggara Timur. (2005). *Tenun  
Ikat Suku Dawan Asal Kabupaten  
Timor Tengah Selatan*. Dinas  
Pendidikan dan Kebudayaan.  
[https://repositori.kemdikbud.go.id/  
29416/1/TENUN%20IKAT%20  
UKU%20DAWAN%20ASAL%20  
KABUPATEN%20TIMOR%20TE  
NGAH%20SELATAN.pdf](https://repositori.kemdikbud.go.id/29416/1/TENUN%20IKAT%20UKU%20DAWAN%20ASAL%20KABUPATEN%20TIMOR%20TENGAH%20SELATAN.pdf)

Wulandari, D. U., Mariana, N.,  
Wiryanto, W., & Amien, M. S.  
(2024). Integration of  
Ethnomathematics Teaching  
Materials in Mathematics Learning  
in Elementary School. *IJORER :  
International Journal of Recent  
Educational Research*, 5(1), 204–  
218.  
[https://doi.org/10.46245/ijorer.v5i1  
.542](https://doi.org/10.46245/ijorer.v5i1.542)