

Ethnomathematics in Bulang and Ampu: Exploring Geometric Concepts in Traditional South Tapanuli Wedding Accessories

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ABSTRACT

Ethnomathematics bridges formal mathematics and culturally embedded practices. This study identifies geometric concepts that can be defensibly inferred from visual evidence in representations of bulang and ampu, traditional South Tapanuli wedding accessories, and examines their potential as contexts for mathematics learning. A descriptive qualitative design employing ethnomathematics-based visual artifact analysis was used. Data comprised visual documentation of the Bulang and Ampu monuments at Alaman Bolak, Padangsidempuan, the researchers' documentation, and relevant scholarly literature. Analysis involved inventorying visual features, coding them according to geometric concepts, comparing the codes with formal definitions, and triangulating interpretations against the literature. The findings indicate that bulang can be modeled in terms of triangles, trapezoids, angles, bilateral symmetry, and repetitive patterns. Ampu displays a conical-frustum form, circular structures, symmetry in its idealized basic form, and repetitive patterns. Translation, reflection, and rotation are more appropriately treated as didactic reconstructions through folding simulations than as direct empirical findings from monument images. The methodological contribution lies in distinguishing observable geometric evidence from pedagogical interpretations developed from cultural objects. These findings can inform contextual geometry activities while maintaining methodological caution in the interpretation of cultural artifacts.



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INTRODUCTION

Mathematics develops not only as a formal system of symbols and rules but is also embedded in the ways communities measure, compare, classify, arrange, construct, and generate patterns in everyday activities. In school mathematics, problems may arise when mathematical concepts are presented in an overly abstract manner and disconnected from students' lived experiences. Such a condition can widen the gap between the mathematics learned in the classroom and the mathematics embedded in students' sociocultural environments. Local cultural contexts can therefore serve as a bridge through which abstract concepts are connected to more concrete and meaningful experiences.

The relationship between mathematics and culture has been widely discussed through the lens of ethnomathematics. D'Ambrosio (2006) conceptualizes ethnomathematics as a program that examines how cultural groups develop mathematical ideas, practices, and representations. Rosa and Orey (2011) emphasize that ethnomathematics is not limited to identifying geometric forms in cultural artifacts; it also situates mathematical knowledge within the social and cultural contexts in which that knowledge develops. From this perspective, ethnomathematical exploration should maintain a balance between mathematical interpretation and respect for the cultural meanings of the objects under study.

Within Indonesian mathematics education, the integration of ethnomathematics is considered relevant because it creates opportunities for contextual learning and enriches conceptual representations. Abi (2017) positions ethnomathematics as a means of connecting the school curriculum with students' cultural experiences, while Richardo (2016) demonstrates that ethnomathematics can support more contextual mathematics instruction within the 2013 Curriculum. Irawan and Kencanawaty (2017) likewise show that culturally grounded learning approaches can be integrated with realistic mathematics education. Cultural artifacts, therefore, need not function merely as illustrations; they can

provide contexts for activities involving observation, classification, measurement, comparison, and mathematical modeling.

Indonesia possesses a rich diversity of cultural artifacts, including traditional houses, carvings, textiles, agricultural tools, performing arts, traditional foods, and ceremonial accessories. Previous studies have shown that these objects can be examined through mathematical concepts. Akbar, Haidar, and Hidayati (2021), for example, identified ethnomathematical concepts in traditional Bugis agricultural tools. Putri (2017) explored mathematical elements in rebana performance as a learning resource, while Pathuddin and Raehana (2019) demonstrated that traditional Bugis foods can also provide contexts for introducing mathematical ideas. This diversity of findings indicates that even small-scale cultural objects may have pedagogical potential when they are analyzed using explicit and defensible criteria.

Among the cultural heritage of South Tapanuli are bulang and ampu, which are worn during traditional wedding ceremonies. Bulang is known as the crown or headpiece worn by the bride, whereas ampu is the traditional head covering worn by the groom. Both have distinctive visual forms and have been represented as monuments at Alaman Bolak in Padangsidempuan City. These representations provide observable visual objects for identifying forms, arrangements, symmetry, and patterns. It must be emphasized, however, that the monuments are representations rather than the original artifacts worn during ceremonies; consequently, geometric interpretations should be restricted to features that are directly visible or supported by other sources.

This study was motivated by the need to investigate bulang and ampu more systematically from the perspective of mathematics education. The purpose is not to prove that the makers of bulang or ampu consciously employed formal geometric terminology, but rather to identify visual forms and regularities that can be modeled mathematically and to assess their potential as learning contexts. This limitation is important in preventing overextended claims that equate every cultural form with a formal mathematical concept without sufficient evidence.

Ethnomathematical studies of cultural artifacts in Indonesia have examined a wide range of objects. Z and Muchlian (2019) explored the Minangkabau rumah gadang and identified geometric elements in its architectural design and visual patterns. Fitri, Sari, and Hartono (2018) identified mathematical concepts in the traditional houses of Ogan Komering Ulu, whereas Rakhmawati (2016) documented culturally embedded mathematical activities in Lampung communities. With respect to ornamentation, Ariyanti and Malasari (2023) identified geometric forms in traditional Kudus carving patterns. Collectively, these studies reveal a strong emphasis on architecture, motifs, and visual structures that can be relatively readily mapped onto formal geometric forms.

Studies of dynamic or process-based cultural objects also provide important directions. (Gazanofa, F. S., 2023) explored ethnomathematical elements in the movements of the plate dance, while Maskar and Anderha (2019) linked geometric transformations to Lampung tapis motifs. Sroyer, Nainggolan, and Hutabarat (2018) identified mathematical concepts in the traditional houses and musical instruments of Biak-Papua. Zaky and Khotimah (2024) used the context of Troso Jepara woven fabric to introduce plane figures. Taken together, these studies show that ethnomathematics can draw on both static forms and patterns or processes as contexts for introducing formal mathematical concepts.

Nevertheless, wedding accessories such as crowns and head coverings have received considerably less attention than traditional houses, textiles, carvings, or dances. In addition, some ethnomathematical studies tend to convert cultural forms directly into geometric terminology without distinguishing between evidence that is genuinely observable and reconstructions created for instructional purposes. This gap is important because the validity of an ethnomathematical study depends not only on the number of mathematical concepts that can be identified, but also on the accuracy of the relationship among visual data, mathematical interpretation, and cultural context.

The novelty of this study lies in two aspects. First, it focuses on bulang and ampu as traditional South Tapanuli wedding accessories whose visual characteristics differ from the architectural and textile objects that dominate previous research. Second, the study explicitly distinguishes between (1) geometric concepts that can be identified directly from visual evidence, such as forms approximating triangles, trapezoids, conical frustums, bilateral symmetry, and repetitive patterns; and (2) concepts developed as didactic reconstructions, such as translation, reflection, and rotation through folding simulations. Based on this gap, the study aims to identify defensible geometric concepts in

representations of bulang and ampu and to formulate their implications for contextual mathematics learning.

The analytical framework positions cultural visual forms as objects that can be modeled mathematically. Modeling is not intended to suggest that cultural artifacts are identical to ideal geometric figures; rather, formal concepts are used to interpret observable regularities. This principle is important because the sides, angles, curves, and proportions of real artifacts do not always satisfy the properties of ideal figures precisely. Accordingly, terms such as 'resembling,' 'approximating,' and 'can be modeled as' are used when the available visual evidence does not permit exact measurement.

The principal concepts used in the analysis include triangles, trapezoids, rectangles, angles, and conical frustums. A triangle is a plane figure bounded by three sides; a trapezoid is a quadrilateral with at least one pair of parallel sides; and a rectangle has two pairs of parallel sides and four right angles. A conical frustum is the portion of a cone obtained when its apex is removed by a plane parallel to the base. In this study, these concepts are used as models for classifying the silhouettes or visual structures of bulang and ampu, rather than as claims about exact geometric measurements.

The regularities examined include symmetry and repetitive patterns. Line symmetry occurs when two parts of a form can be mapped onto one another by reflection across a line. Rotational symmetry occurs when a form returns to an equivalent configuration after a specified rotation about a center. For artifacts containing asymmetric ornaments, the assessment of rotational symmetry must be restricted to the idealized basic form rather than the entire object. Translation, reflection, and rotation are therefore treated cautiously: they are identified as empirical findings only when supported by evidence of a process or pattern; otherwise, they are positioned as possible learning activities developed through reconstruction or simulation.

RESEARCH METHOD

This study employed a descriptive qualitative method using ethnomathematics-based visual artifact analysis. This approach was selected because the primary data consist of visual representations of bulang and ampu and related documentation analyzed to identify mathematical regularities. The term 'ethnography' is not used as the principal research design because the study did not involve long-term participant observation, in-depth interviews with cultural practitioners, or a comprehensive description of a community's way of life, as is typically required in ethnographic research. The analysis instead focuses on representations of cultural artifacts and their potential for mathematics learning.

The objects of analysis were representations of the Bulang Monument and Ampu Monument located at Alaman Bolak, Padangsidempuan City, North Sumatra. The image of the Bulang Monument was taken from documentation published by the Padangsidempuan City Office of Communication and Informatics (2017), whereas the image of the Ampu Monument was drawn from the researchers' documentation collected in 2026. Scholarly literature was used as a comparative source to situate the findings within Indonesian ethnomathematics research. The units of analysis therefore comprised observable visual features in the images: silhouettes, arrangements of components, lines, angles, plane or three-dimensional forms approximating ideal geometric figures, left-right balance, repetitive patterns, and relationships among components.

Data were collected through documentation and a literature review. Documentation provided sufficiently clear visual evidence for geometric identification, while the literature review was used to compare the findings with ethnomathematical research on other cultural objects and to ensure that interpretations remained connected to the discourse of mathematics education. The study did not use interview data from traditional leaders, artisans, bridal stylists, or other cultural practitioners. Consequently, statements concerning philosophical meanings, production techniques, or the makers' mathematical intentions were not treated as principal findings unless they were explicitly supported by a source.

The analysis was conducted in four stages. First, the researchers inventoried the visual features of each object. Second, these features were coded according to relevant geometric concepts, such as forms resembling triangles, trapezoids, conical frustums, bilateral symmetry, or repetitive patterns. Third, the coded features were compared with formal geometric properties to determine whether an interpretation could reasonably be treated as a visual finding or only as an approximate model. Fourth, the findings were compared with previous studies to assess similarities, differences, and pedagogical contributions. At this stage, geometric transformations associated with folding were classified as

didactic reconstructions when sequential visual evidence of the process of forming an ampu was unavailable.

Interpretive validity was strengthened through source triangulation and explicit limitation of claims. Triangulation involved comparing visual documentation, source descriptions, and findings from relevant ethnomathematical studies. Claims were bounded by distinguishing three levels of interpretation: (1) directly observable in the visual representation; (2) a geometric idealization that still requires assumptions; and (3) a pedagogical reconstruction developed for learning activities. This strategy was adopted to keep the analysis transparent and traceable to the evidence and to prevent researchers' inferences from being presented as unsupported cultural facts.

RESULTS AND DISCUSSION

Ethnomathematical Analysis of Bulang



Figure 1. The Bulang Monument, a representation of the traditional South Tapanuli bridal crown located at Alaman Bolak, Padangsidimpuan City

Source: Padangsidimpuan City Office of Communication and Informatics (2017)

Figure 1 presents the Bulang Monument as a visual representation of the traditional South Tapanuli bridal crown. At the observational level, the upper part of the monument forms a tapering silhouette with a relatively balanced left-right composition, whereas the lower part consists of a circular supporting structure. Because the object shown is a monument rather than an original bulang worn by a bride, the analysis is restricted to visible structural features and is not used to infer the dimensions, materials, or production techniques of the actual accessory.

The upper silhouette of the bulang can be modeled as a triangular form. This modeling is particularly useful for identifying sloping sides, the apex, angles, altitude, and the relationship between the base and the apex. In the tiered sections, several surfaces resemble trapezoids because the upper and lower edges appear relatively parallel while the lateral sides taper. The term 'resemble' is used deliberately because the photograph does not provide measurement data that would verify similarity or parallelism exactly. Such an approach is consistent with cultural artifact analysis, in which mathematical modeling is preferable to forcing real forms into ideal geometric categories.

The strongest visual feature is bilateral balance. If an imaginary vertical line is drawn through the center of the bulang, the principal structures on the left and right appear broadly similar. This feature allows the object to be used to introduce the concepts of an axis of symmetry and reflection. The ornamental details, however, are not always perfectly identical; thus, it is more accurate to refer to 'bilateral symmetry in the main structure' than to claim perfect line symmetry across every detail of the object.

The ornaments on the surface of the bulang also display repeated forms and visual rhythms. These repetitive patterns can be used to discuss regularity, sequences, and simple transformations in motifs when sufficiently clear visual segments are available. Ariyanti and Malasari demonstrate that repetition and geometric structure in traditional carvings can provide a context for examining shapes and symmetry. The findings for bulang extend this possibility to wedding accessories, with the

important qualification that indistinct motifs in a photograph should not be forced into a particular transformation category. (Ariyanti, I. E., & Malasari, 2023)

From a pedagogical perspective, bulang can be used as an observational context before students move toward formal representations. Teachers may ask students to identify forms approximating triangles or trapezoids, estimate an axis of symmetry, compare the proportions of upper and lower sections, and discuss why a given form only 'approximates' an ideal figure. Such activities are important because learning geometry involves not only recognizing perfect examples but also developing the ability to model real-world objects using mathematical representations.

When incorporated into a student worksheet, activities based on bulang can be developed progressively. At the elementary level, students may identify sides, angles, and patterns. At a more advanced level, they may measure a scaled image, estimate height-to-width ratios, test for an axis of symmetry, or reconstruct the form using geometric instruments. This type of instructional model links a cultural context with explicit mathematical activity, consistent with Abi's (2017) discussion of integrating ethnomathematics into the curriculum and Richardo's (2016) account of contextual mathematics learning.

Ethnomathematical Analysis of Ampu



Figure 2. The Ampu Monument, a representation of the traditional South Tapanuli groom's head covering located at Alaman Bolak, Padangsidimpuan City

Source: researchers' documentation (2026)

Figure 2 shows the Ampu Monument as a representation of the traditional South Tapanuli groom's head covering. The upper structure resembles a conical frustum, with a circular rim at the top and a wider lower section, while the monument's base consists of a tiered cylindrical form. This observation provides stronger visual evidence for three-dimensional geometric concepts than for claims about the shape of the fabric before folding, because neither the material nor the production process of the original ampu is visible in the image.

The conical frustum form can be used to discuss the distinction between a full cone and a conical frustum, the diameters of the upper and lower circles, height, and the relationship between two-dimensional representations and three-dimensional objects. However, because the monument includes an elongated ornament on its surface, the object as a whole cannot be described as having perfect rotational symmetry. Rotational symmetry can only be discussed for the idealized basic form after disregarding ornaments that are not uniformly repeated.

Several small elements on the surface of the ampu appear to repeat around the circumference. These features may be used to examine periodic patterns, spacing between elements, or divisions of central angles when images of sufficient resolution and appropriate viewing angles are available. This type of regularity is comparable to pattern analyses of other cultural objects, including Lampung tapis motifs examined by (Maskar, S., & Anderha, 2019), although the objects and modes of representation differ.

Claims concerning translation, reflection, and rotation in the folding process of an ampu should be treated methodologically as didactic reconstructions rather than direct observational findings. The monument image shows only the final form and does not document a sequence of folding stages. Teachers may therefore develop simulations using rectangular paper or fabric to demonstrate how reflection, rotation, or translation may arise while constructing a model head covering. Such a reconstruction is legitimate as an instructional design provided that it is clearly distinguished from a claim about the authentic process of making an ampu.

This distinction strengthens the contribution of the study. In ethnomathematics research, the objective is not to extract as many mathematical concepts as possible from a single cultural object. More important is the ability to explain the relationship among the object, the evidence, and the concept. This cautious approach is consistent with Rosa, M., & Orey, 2011 argument that cultural mathematics should not be reduced to a list of formal concepts without attention to context and to the ways knowledge is represented.

For instructional purposes, ampu offers opportunities that differ from those provided by bulang. Whereas bulang is more suitable for introducing plane figures and bilateral symmetry, ampu offers greater potential for connecting three-dimensional forms, cross-sections, circular patterns, and transformation modeling through simulation. These differences enable teachers to use the two objects complementarily: bulang as a context for plane geometry and ampu as a bridge toward solid geometry and transformations.

Summary of Geometric Concepts in Bulang and Ampu

Table 1 summarizes the geometric concepts that can be associated with bulang and ampu. The summary should be interpreted in conjunction with the evidentiary status described in the results: some concepts are relatively directly observable in the visual structure, whereas others require idealization or are positioned as reconstructions for instructional purposes.

Overall, bulang provides stronger evidence for modeling plane figures, angles, bilateral symmetry, and repetitive patterns. Ampu provides stronger evidence for modeling a conical frustum, circular structures, and periodic patterns. Geometric transformations in ampu are not treated as factual features of the production process because the study did not document a sequence of folding stages; instead, they are positioned as possible didactic activities. This distinction provides the basis for formulating more accurate instructional implications.

Table 1. Summary of Geometric Concepts in Bulang and Ampu

Geometric Concept	Identified in Bulang	Identified in Ampu
Triangle	The peak silhouette can be modeled as a triangle	-
Trapezoid	Several tiered sections approximate a trapezoid	-
Conical frustum	-	Basic form of the upper part of the monument
Angles	Angles at the peak and tiered sections	Angles may be examined in cross-sections or ornaments
Line symmetry	Bilateral balance of the main structure	May be discussed with limitations for particular structures
Rotational symmetry	-	Only in the idealized basic form
Geometric transformations	Potentially applicable to motif analysis when evidence is sufficient	Didactic reconstruction through folding simulation
Repetitive pattern	Repeated ornaments	Repeated elements around the circumference

Strength of Evidence and Limits of Geometric Interpretation

To prevent the findings from becoming an overly permissive list of concepts, each finding was classified according to the strength of its evidence. The category 'observed' was used when a visual

feature was visible in the image; 'idealization' was used when a concept applied only after the real form had been simplified into an ideal figure; and 'didactic reconstruction' was used when a concept was developed for a learning activity but was not directly documented in the data. This distinction is important for maintaining the internal validity of the study while still allowing room for pedagogical creativity.

Table 2. Mapping of Visual Evidence, Interpretation Status, and Potential Learning Activities

Visual Evidence/Object	Geometric Concept	Interpretation Status	Potential Learning Activity
Peak silhouette of bulang	Triangle and angles	Observed as an approximate form	Marking sides, angles, altitude, and constructing a triangle model
Tiered arrangement of bulang	Trapezoid and proportion	Observed as an approximate form	Identifying parallel sides and comparing size ratios
Left-right balance of bulang	Line symmetry	Observed in the main structure	Determining an axis of symmetry and constructing a reflected image
Basic form of ampu	Conical frustum	Idealization of a three-dimensional geometric form	Comparing a cone and a conical frustum; constructing a net/model
Repeated elements on ampu	Periodic pattern and central angle	Observation limited by image resolution	Analyzing repetition and circular partitioning
Folding simulation of an ampu model	Reflection, rotation, translation	Didactic reconstruction, not an observation of the authentic process	Simulating with paper/fabric and recording transformations

Table 2 shows that instructional contributions need not depend on the claim that all mathematical concepts were consciously used by the makers of the artifacts. Teachers may use observable forms as starting points for modeling and subsequently develop appropriate mathematical tasks. In this way, the cultural context serves as a stimulus for mathematical activity, while conceptual accuracy is maintained through formal definitions and explicit discussion of model limitations.

Degree of Accuracy in Geometric Modeling

Geometric modeling of cultural artifacts should be understood as a process of abstraction. A real object has texture, thickness, curvature, irregularities, and variations in form that cannot always be reduced to a single ideal figure. The accuracy of an analysis should therefore be judged not by the number of geometric labels attached to an object, but by the researcher's ability to explain the visual basis and limitations of the model employed. In this study, triangular and trapezoidal forms in bulang are treated as approximate models, whereas the conical frustum is used to characterize the overall upper form of the Ampu Monument. Using the language of approximation makes the analytical process more transparent and enables readers to evaluate the plausibility of the interpretation.

The same principle is important when discussing symmetry. In ideal figures, symmetry can be tested precisely through reflection or rotation. In real artifacts, decorative elements may create minor differences between two sides. The main structure of bulang is therefore more accurately described as showing a tendency toward bilateral symmetry than as exhibiting perfect symmetry in every detail. Likewise, ampu can be treated as rotationally symmetric only when the analysis is restricted to the idealized conical-frustum base form. The elongated surface ornament means that the entire representation is not identical after arbitrary rotation. Such limitations can themselves provide productive material for mathematical discussion because students learn to distinguish the properties of ideal figures from those of empirical objects.

Repetitive patterns have comparatively stronger evidentiary status when the same elements can be observed repeatedly in an image. Visual repetition, however, does not necessarily establish which transformations were used during production. (Puspawati, K. R., & Putra, 2014) show that weaving can be analyzed through patterns and regularities, while (Rakhmawati, 2016) demonstrates how mathematical activity is embedded in the cultural context of Lampung. Both examples underscore the importance of linking concepts to structures that are actually observable. In bulang and ampu, repetitive patterns can be used to introduce visual sequences, periodicity, and spatial partitioning without asserting that artisans consciously applied particular formal transformations.

From an instructional perspective, the imperfections of real forms are not weaknesses but sources of mathematical problems. Students may be asked to justify why a particular section is 'sufficiently appropriate' to model as a triangle, identify deviations from an ideal trapezoid, or explain why an object does not satisfy perfect rotational symmetry. Such questions promote argumentation, estimation, and modeling. Ethnomathematics can thus move beyond shape-recognition activities toward higher-level mathematical practices: making assumptions, testing models, and articulating the limits of a conclusion's validity.

Discussion: Positioning the Findings within Ethnomathematics Research

The findings indicate that the principal strength of bulang and ampu as ethnomathematical contexts lies in the diversity of geometric representations offered by two different objects. Bulang predominantly highlights plane geometry and bilateral balance, whereas ampu is more readily associated with solid geometry and circular structures. This distinction provides a more specific contribution than merely stating that both objects 'contain geometry.' Cultural objects can be selected according to the type of mathematical activity intended for classroom development.

The findings for bulang resemble studies of traditional houses and carvings in which triangles, trapezoids, symmetry, and patterns are dominant features. (Z, Y. R., & Muchlian, 2019) and (Fitri, E., Sari, P., & Hartono, 2018) demonstrate that traditional architectural structures can be modeled using geometric concepts, while (Ariyanti, I. E., Malasari, 2023) emphasize formal regularity in Kudus carvings. Bulang differs, however, in scale and cultural function, enabling geometric discussion to move from monumental structures toward an accessory closely associated with the body and social ceremony.

The findings for ampu extend the discussion to solid geometry and process modeling. (Maskar, S., & Anderha, 2019) demonstrate the potential of tapis motifs for learning geometric transformations, while (Gazanofa, F. S., 2023) show that mathematical elements can also be explored through dance movements. In the present study, transformations are not presented as authentic practices in ampu production because process data are unavailable. This methodological position constitutes an important contribution: ethnomathematics research should distinguish between what is genuinely supported by cultural data and what researchers construct as an instructional scenario.

From an educational perspective, this approach also prevents culture from being used merely as decoration. Local artifacts should not simply be appended to mathematics problems; instead, they should become sources for observing, conjecturing, modeling, measuring, comparing, and checking the fit between a mathematical model and the object. This principle is consistent with (Irawan, A., 2017), who situate contexts close to students' experiences within realistic mathematics education, and with (Putri, 2017) who demonstrates the potential of traditional arts as mathematics learning resources.

Conceptual and Methodological Contributions

Conceptually, this study shows that wedding accessories can broaden the range of ethnomathematical objects that has largely centered on architecture, textiles, and the arts. Traditional houses provide large-scale forms and relatively explicit structures, whereas accessories present geometry on a smaller scale, closer to the body, and embedded in ceremonial functions. This difference in scale is important because it offers varied ways for students to examine the relationship between form and function. The findings complement studies by (Fitri, E., Sari, P., & Hartono, 2018) on traditional houses, (Sroyer, A. M., Nainggolan, J., & Hutabarat, 2018) on houses and musical instruments, and (Zaky, M. H., & Khotimah, 2024) on woven textiles.

The methodological contribution lies in classifying the status of interpretations. In visual explorations, researchers risk treating 'can be used to explain a concept' as equivalent to 'the concept was actually used by the community in the cultural process.' These statements are not identical. The

former is a didactic claim, whereas the latter is an empirical claim about cultural practice. By distinguishing observed findings, idealizations, and didactic reconstructions, this study seeks to preserve that boundary. This straightforward framework may also be applied to other documentation-based ethnomathematics studies when process data or interviews are unavailable.

This distinction also affects how novelty is articulated. Novelty need not mean identifying a geometric concept that has never appeared in previous research. Triangles, symmetry, and patterns have already been documented in many cultural objects. Novelty may instead lie in an understudied object, a distinctive combination of geometric characteristics, the manner in which evidence is classified, and the pedagogical consequences derived from the analysis. In the context of bulang and ampu, the principal contribution is not the discovery of a 'new triangle,' but a structured mapping of which concepts are strongly supported visually, which require idealization, and which are more appropriately positioned as instructional scenarios.

This framework is consistent with the aim of ethnomathematics to bridge academic mathematics and knowledge developed within cultural settings without erasing the distinction between them (D'Ambrosio, 2006; Rosa & Orey, 2011). For mathematics education, this position is important because it prevents culture from being treated merely as decoration or as a superficial wrapper for mathematics problems. Cultural contexts should provide material for developing defensible mathematical activities, while cultural meanings not supported by the available data should be acknowledged as areas requiring further investigation.

Implications for Mathematics Learning

In geometry instruction, teachers can use bulang and ampu as contexts for constructing a progression from concrete observation to abstraction. The first stage involves observing an image or replica and asking students to record the features they notice without initially naming geometric figures. The second stage involves classifying those features according to similarities in form, symmetry, or pattern. In the third stage, students model selected parts using formal geometric figures. The fourth stage examines the limitations of the model: students explain which features fit the ideal form and which do not match it precisely. This sequence develops both conceptual understanding and mathematical reasoning.

In practical terms, student worksheets can contain tasks differentiated by educational level. At the elementary level, students may count sides and angles, identify patterns, and determine a line that may function as an axis of symmetry. At the lower-secondary level, students may measure scaled images, calculate ratios, construct reflections, or build a conical-frustum model. For transformation topics, students may conduct paper-folding simulations and record changes in the positions of points or lines. Such activities do not claim to reproduce the authentic process of making an ampu; rather, they use ampu as inspiration for a didactic context. This approach is consistent with the integration of culture into the mathematics curriculum (Abi, 2017).

This instructional potential also carries value for cultural literacy. Students learn not only geometry but also encounter local artifacts as part of community knowledge. Nevertheless, the aim of cultural preservation should not be used to obscure the empirical limitations of the study. The effectiveness of bulang and ampu as instructional media has not yet been tested with students; the present study therefore claims only pedagogical potential. Evaluating effects on learning outcomes, motivation, or modeling ability requires subsequent design-based or experimental research.

Design for Classroom Implementation

The use of bulang and ampu in learning can be designed around an 'observation-modeling-verification-reflection' sequence. During observation, students examine an image or replica without first receiving a list of concepts. They record forms, lines, patterns, and parts they consider symmetrical. During modeling, students select a particular section and represent it using geometric figures. During verification, the properties of the selected figure are compared with the object, requiring students to explain both correspondences and discrepancies. Reflection is then used to discuss the idea that a mathematical model is a simplification of reality rather than a perfect copy.

For plane-geometry topics, bulang can be used to initiate the identification of triangles, trapezoids, angles, and line symmetry. Teachers may provide photographs with guide lines or simple coordinates so that students can measure relative lengths and estimate angle measures. The activity can

continue by asking students to draw an idealized version using a ruler and protractor and then compare it with the original form in the photograph. This approach is consistent with (Putri, 2017) use of cultural contexts as learning resources and Abi's (2017) discussion of integrating ethnomathematics into school mathematics.

For solid-geometry topics, ampu can provide a context for comparing a full cone, a conical frustum, and a cylinder. Students may construct a simple paper model, measure the diameters of the two circles, and estimate the model's height. When transformations are being studied, teachers may add a paper-folding activity as a didactic simulation. Each folding stage can include a reference point so that students can trace changes in point position under reflection or rotation. Teachers should explicitly explain that the simulation is an instructional model rather than authentic documentation of the process of making an ampu.

In group-based learning, the two objects can be compared to develop students' argumentation skills. One group may analyze bulang and another ampu, after which each group presents the rationale for its selected geometric model. Responding groups are asked to test whether the stated properties are actually visible in the object. This strategy shifts the emphasis from a single correct answer toward the quality of the reasoning provided. Within realistic mathematics education, such activities allow students to move gradually from a contextual situation to a mathematical model (Irawan, A., 2017).

Table 3. Example Sequence of Learning Activities Based on Bulang and Ampu

Stage	Student Activity	Targeted Concept	Product/Assessment
Observation	Marking forms, lines, patterns, and parts considered symmetrical in the photograph	Geometric observation and patterns	Observation notes
Modeling	Redrawing parts of bulang/ampu using ideal geometric figures	Triangle, trapezoid, conical frustum	Annotated drawing/model
Measurement	Measuring relative lengths, angles, diameters, or ratios on a scaled image	Angles, ratios, proportions	Measurement table
Transformation	Conducting a paper-folding simulation using reference points	Reflection, rotation, translation	Sequence of transformation drawings
Verification	Testing how well the properties of ideal figures fit the cultural object	Reasoning and model validation	Written/group argument
Reflection	Explaining model limitations and distinguishing visual findings from simulations	Mathematical modeling and cultural literacy	Reflective paragraph

The design presented in Table 3 is illustrative and can be adapted to students' educational level, learning objectives, and available media. Assessment should focus not only on the ability to name geometric figures but also on the quality of modeling, the accuracy of reasoning, and the ability to explain model limitations. Through this approach, the cultural context functions both as a source of mathematical problems and as material for developing a critical understanding of the relationship between formal representations and real objects. (Pathuddin, H., & Raehana, 2019) demonstrate that everyday cultural objects can serve as learning resources when mathematical concepts are formulated in a purposeful manner; the same principle is applied here to traditional accessories.

Research Limitations and Recommendations

This study has three principal limitations. First, the visual data are centered on monumental representations; consequently, the materials, dimensions, and construction of authentic bulang and ampu could not be examined directly. Second, the study did not include interviews with traditional leaders, artisans, bridal stylists, or wearers of the accessories; symbolic meanings and production techniques were therefore not used as a basis for claims. Third, the study did not evaluate the use of bulang and ampu in actual classroom settings. Future research should document authentic artifacts from multiple sources, record production stages, and interview cultural practitioners to examine mathematical interpretations from an emic perspective. Subsequent work may also develop student worksheets or other instructional materials and empirically test their effects on modeling ability, geometric understanding, and student engagement.

CONCLUSION

This study concludes that representations of bulang and ampu can provide ethnomathematical contexts for exploring geometry at different levels of evidentiary strength. In bulang, the most strongly supported visual concepts include forms that can be modeled as triangles and trapezoids, angles, bilateral symmetry, and repetitive patterns. In ampu, the basic form can be modeled as a conical frustum with circular structures, whereas rotational symmetry is appropriately discussed only for the idealized basic form. Translation, reflection, and rotation associated with folding are not positioned as empirical findings because the production stages were not documented in the data; these concepts are more appropriately used as didactic reconstructions through simulation. The novelty of the study lies in distinguishing among observable geometric evidence, mathematical idealization, and pedagogical reconstruction. Through this distinction, bulang and ampu can serve as sources of contextual geometry activities while methodological precision is maintained. Future research should examine authentic artifacts, involve cultural practitioners, and develop and evaluate instructional materials before conclusions are drawn regarding their effectiveness for student learning.

REFERENCES

- Abi, A. M. (2017). Integrasi etnomatematika dalam kurikulum matematika sekolah. *JPMI (Jurnal Pendidikan Matematika Indonesia)*, 1(1), 1–6.
<https://doi.org/https://doi.org/10.26737/jpmi.v1i1.75>
- Ariyanti, I. E., & Malasari, P. N. (2023). Etnomatematika bentuk bangun geometri pola seni ukiran Kudus pada rumah adat Jawa. *Jurnal Pendidikan Matematika*, 3(2), 150–162.
<https://doi.org/https://doi.org/10.28918/circle.v3i2.1026>
- Fitri, E., Sari, P., & Hartono, Y. (2018). Etnomatematika pada kebudayaan rumah adat Ogan Komerling Ulu Sumatera Selatan. *Journal of Medives*, 2(1), 137–144.
- Gazanofa, F. S., & W. (2023).). Eksplorasi etnomatematika pada gerak tari piring. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 7(3), 3162–3173.
<https://doi.org/https://doi.org/10.31004/cendekia.v7i3.2679>
- Irawan, A., & K. (2017). Implementasi pembelajaran matematika realistik berbasis etnomatematika. *Journal of Medives*, 1(2), 74–81.
- Maskar, S., & Anderha, R. R. (2019). Pembelajaran transformasi geometri dengan pendekatan motif kain tapis Lampung. *Jurnal Pendidikan Matematika*, 1(1), 40–47.
- Pathuddin, H., & Raehana, S. (2019). Etnomatematika: Makanan tradisional Bugis sebagai sumber belajar matematika. *MaPan: Jurnal Matematika Dan Pembelajaran*, 7(2), 307–327.
<https://doi.org/https://doi.org/10.24252/mapan.2019v7n2a10>
- Puspadewi, K. R., & Putra, I. G. N. N. (2014). Etnomatematika di balik kerajinan anyaman Bali. *Jurnal Matematika*, 4(2), 80–89.
- Putri, L. I. (2017). Eksplorasi etnomatematika kesenian rebana sebagai sumber belajar matematika pada jenjang MI. *Jurnal Ilmiah Pendidikan Dasar*, 4(1), 21–31.
- Rakhmawati, R. (2016). Aktivitas matematika berbasis budaya pada masyarakat Lampung. *Al-Jabar: Jurnal Pendidikan Matematika*, 7(2), 221–230.
- Rosa, M., & Orey, D. C. (2011). No Ethnomathematics: The cultural aspects of mathematics. *Revista*

Latinoamericana de Etnomatemática, 4(3), 2–54.

- Sroyer, A. M., Nainggolan, J., & Hutabarat, I. M. (2018). Exploration of ethnomathematics of house and traditional music tools Biak-Papua cultural. *Formatif: Jurnal Ilmiah Pendidikan MIPA*, 8(3), 175–184.
- Z, Y. R., & Muchlian, M. (2019). Eksplorasi etnomatematika rumah gadang Minangkabau Sumatera Barat. *Jurnal Analisa*, 5(2), 123–136. <https://doi.org/https://doi.org/10.15575/ja.v5i2.5942>
- Zaky, M. H., & Khotimah, P. R. (2024). Etnomatematika: Pengenalan bangun datar melalui konteks kain tenun Troso Jepara. *Jurnal Cendekia: Jurnal Pendidikan Matematika*, 8(1), 441–453.