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Review Articles

An Exploration of Ethnomathematics in Cultural Objects and Traditional Foods of North Sumatra: A Study of Basic Geometric Elements

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ABSTRACT

Ethnomathematics examines how mathematical ideas are embedded in cultural practices, artefacts, and everyday activities. Although studies have documented geometric ideas in individual cultural objects and food traditions in North Sumatra, their findings remain dispersed and are not always distinguished from interpretations proposed by later authors. This directed narrative review synthesizes 25 journal articles published between 2021 and 2026 and one reference book identified through academic search engines and journal portals. The review examines studies concerning Rumah Bolon, gorga and ulos motifs, Sortopi, keteng-keteng, museum buildings and collections, and traditional foods such as lemang, lappet, kipang, and alame. The synthesis organizes the evidence around points, lines, planes, angles, plane figures, solid figures, symmetry, and geometric transformations. It distinguishes concepts explicitly discussed in the literature from provisional models proposed by the authors. The reviewed studies provide the clearest object-specific evidence for architectural forms, textile motifs, Sortopi, keteng-keteng, and selected museum features. By contrast, several food-related interpretations and the proposed model of solu bolon require direct visual or field verification. The article contributes an evidence map and a case-based learning scenario for prospective elementary teachers. It also emphasizes that geometric modelling is an analytical representation and should not be treated as a complete account of an artefact's cultural meaning.

Keywords: *Ethnomathematics; North Sumatra; geometry education; cultural heritage; traditional food*

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INTRODUCTION

Background of the Study

Mathematics is not confined to formal symbols or classroom procedures. It is also expressed through the ways communities design, construct, classify, measure, and use objects in everyday life. Ethnomathematics examines mathematical ideas and practices in relation to the cultural environments in

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which they develop; it therefore requires attention not only to the mathematical patterns identified by researchers but also to the social meanings and practices associated with them (Rosa et al., 2017). In education, cultural artefacts can provide meaningful contexts for mathematical investigation, provided that teachers avoid treating an idealized geometric model as a complete account of the artefact. Reviews of ethnomathematics research identify geometry as a frequently investigated area and discuss its potential to connect mathematical reasoning with culturally situated experience (Hendriyanto et al., 2023; Kyeremeh et al., 2023). In elementary education, such contexts may support numeracy and reasoning when teachers select accurate examples and make the mathematical ideas explicit (Utami et al., 2026; Astuti & Rozikin, 2025).

North Sumatra offers a wide range of cultural expressions, including traditional architecture, decorative motifs, textiles, musical instruments, museum collections, and regional foods. Studies of Batak cultural contexts have reported mathematical ideas in architectural forms, ornaments, textiles, and other cultural practices (Ginting et al., 2024). More focused investigations have examined Rumah Bolon and its ornaments (Sihombing & Tambunan, 2021; Mailani et al., 2024c), ulos patterns (Basmara, 2024; Mailani et al., 2024b; Gultom & Lubis, 2025), the Sortopi head covering (Mailani et al., 2024a), keteng-keteng (Sitepu et al., 2025), and museum buildings or collections (Safriyanti & Yahfizham, 2023; Sagala & Hasanah, 2023). Research has also considered geometric interpretations of traditional foods (Khairum et al., 2025; Kartika, 2024).

The Problem of The Study

Despite this growing body of research, findings are distributed across separate objects and research questions. This makes it difficult for readers and educators to compare which geometric concepts have been documented for particular objects and which concepts are inferred by subsequent authors. The distinction is important: a geometric model is a selective abstraction of observable features and cannot, by itself, establish an artefact's full form, function, history, or cultural meaning. This review therefore asks: Which basic geometric concepts have been reported, or can cautiously be modelled, in selected North Sumatran cultural objects and traditional foods, and how can the available evidence inform mathematics learning?

Research's State of the Art

Studies of Rumah Bolon have discussed plane figures, symmetry, proportion, and architectural components, while research on its ornaments has identified geometric patterns in selected decorative forms (Sihombing & Tambunan, 2021; Mailani et al., 2024c; Putri et al., 2025). Studies of ulos have examined flat shapes and transformations in repeated motifs (Basmara, 2024; Mailani et al., 2024b; Gultom & Lubis, 2025). Other studies address the triangular form of Sortopi, cylindrical modelling of keteng-keteng, and geometric features in museum buildings or collections (Mailani et al., 2024a; Sitepu et al., 2025; Safriyanti & Yahfizham, 2023; Sagala & Hasanah, 2023). These findings are object-specific. They should not be generalized to every example of an object or interpreted as evidence that a complex cultural artefact is identical to a single ideal geometric figure.

Food-related research has discussed curved-surface solids in selected North Sumatran foods (Khairum et al., 2025), while other studies provide examples of modelling regional foods through plane and solid geometry (Kartika, 2024; Shabira & Widiyasari, 2025; Aprianto et al., 2026). Such studies demonstrate the educational potential of food as a contextual resource, but they do not establish that every item of lemang, lappet, kipang, or alame has a uniform geometric form. In this review, these foods are treated as possible contexts for examining observable characteristics—including length, cross-section, folds, cut surfaces, thickness, and arrangement—provided that the specific specimen is documented.

Novelty, Research Gap, & Objective

The gap addressed here is not merely the absence of a combined list of cultural objects. Rather, an evidence-conscious synthesis is needed that (a) compares the object groups and geometric concepts discussed in previous studies, (b) distinguishes published findings from the present authors' provisional interpretations, and (c) translates the resulting evidence into a learning task for prospective elementary teachers. Accordingly, this review aims to identify geometric concepts reported in selected North Sumatran

cultural objects and foods, clarify the evidential status of each mapping, and propose a contextual Case Method scenario. Its contribution is an integrated evidence map that makes the boundary between literature-based findings and author-generated models explicit.

METHOD

Type and Design

This article adopts a directed narrative literature review. It is a focused synthesis of selected publications rather than a systematic review, and it does not claim exhaustive coverage of all cultural objects or foods in North Sumatra. The review analyses published descriptions and geometric interpretations; it does not report measurements of physical specimens or new field observations. No human participants were involved.

Data and Data Sources

The review corpus consists of 25 journal articles published between 2021 and 2026 and one reference book, as listed in the References. The unit of analysis is a description, geometric concept, or educational implication associated with a cultural object, food, or learning approach. For each source, the review recorded the object discussed, the geometric concept identified by the source, and the relevance of the finding to the present synthesis. When a source did not explicitly establish a particular geometric interpretation, that interpretation was classified as provisional author modelling rather than attributed to the source. The manuscript records do not include a complete search log, database export, or formal quality-appraisal scores; consequently, these details are not reported as if they had been documented.

Data Collection Technique

The source manuscript records searches through academic search engines and online journal portals. The search terms reported by the authors included “North Sumatra ethnomathematics,” “geometric ethnomathematics,” “Rumah Bolon,” “ulos,” “museums,” “traditional foods,” and “Case Method.” The stated eligibility considerations were topical relevance to ethnomathematics, geometry, cultural objects, traditional foods, or the Case Method; publication as a journal article within 2021–2026 or as a relevant reference book; and availability of accessible full text. The manuscript does not preserve a dated search log, complete platform list, exported search results, or a record of the number of records screened and excluded. Consequently, this review does not report database-specific search dates, record counts, or a PRISMA flow diagram. These details are not reconstructed retrospectively because doing so would risk presenting unrecorded procedures as facts. The 25 journal articles and one book therefore constitute the documented review corpus, not a claim of exhaustive retrieval. Before any new submission or formal republication, the authors should retain a prospective search log containing platform names, exact dates, complete search strings, record counts, duplicate-removal decisions, and full-text exclusion reasons.

Data Analysis

The synthesis proceeded in three stages. First, the sources were grouped by the cultural object, food, or educational approach examined. Second, geometric concepts explicitly identified in each source were extracted and separated from interpretations inferred by the present authors. Third, each proposed mapping was evaluated in terms of its observable basis, evidential status, and possible relevance to elementary geometry learning. For synthesis purposes, mappings were treated as (1) literature-reported when the cited study explicitly analysed the relevant object or feature, or (2) provisional author modelling when the proposed geometric form was inferred from a general description or an image without direct examination of the specimen. The evidence map therefore does not treat all mappings as equally established. Because no fieldwork or specimen measurement was conducted, interpretations that depend on the precise physical appearance of an object remain tentative.

RESULTS

Studies of Rumah Bolon describe architectural and ornamental features that can be examined in terms of symmetry, proportion, lines, angles, and plane figures. Reported examples include triangular, trapezoidal, rectangular, circular, and other forms in selected structural or decorative components

(Sihombing & Tambunan, 2021; Mailani et al., 2024c). These categories should be applied to clearly identified components rather than to the building as a whole. In particular, the visible outline of a roof may be curved and may vary across buildings or regional forms. A triangle may therefore serve as a two-dimensional approximation of a selected outline, but it should not be presented as an exact or exhaustive description of the roof.



Figure 1. Rumah Bolon (Batak traditional house). Image reproduced from R. Marpaung (2019), Wikimedia Commons, under the CC BY-SA 4.0 licence.

Studies of ulos describe flat geometric patterns, including squares, rectangles, rhombuses, and triangles, and examine symmetry or transformations in repeated motifs (Basmara, 2024; Mailani et al., 2024b; Gultom & Lubis, 2025). The most appropriate unit of analysis is a specific motif or repeated arrangement visible in the textile, rather than the entire cloth treated as one geometric figure. The geometric description should also be distinguished from the motif's cultural, social, and symbolic meanings, which cannot be inferred from shape alone.



Figure 2. Gorga ornamental motif.
Source: infobudaya.net (2021).

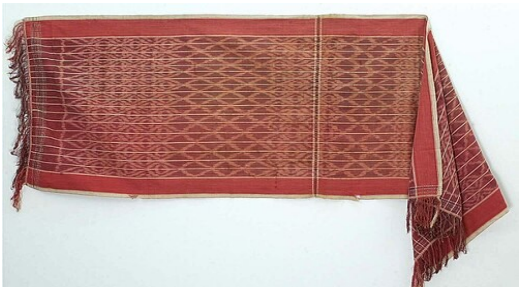

Figure 3. Ulos textile motif.
Source: Wikimedia Commons (2024).

Research on the State Museum of North Sumatra has examined geometric features in its building and selected collections (Safriyanti & Yahfizham, 2023; Sagala & Hasanah, 2023). A study of keteng-keteng specifically relates the instrument's body to a cylinder (Sitepu et al., 2025). This model can support discussion of a curved surface and an approximately circular end profile, provided that the physical instrument is examined before exact dimensions or circularity are claimed. Solu bolon is included here only

as a possible topic for future modelling: the references in the present corpus do not provide a specific study that substantiates the detailed geometric mapping proposed for it.

A comparison across these cases suggests that the certainty of a geometric classification depends on the scale and nature of the evidence. A clearly bounded motif or an instrument body provides a more direct basis for identifying a plane figure or solid than a complex building or an irregular food item. Museum-based studies also require object-level attribution: a geometric feature observed in one display object cannot be generalized to the entire collection. This difference in evidential strength is reflected in Table 1 and should guide how confidently each example is presented to learners.

Traditional Foods

Research on North Sumatran traditional foods has identified curved-surface solid concepts in selected local foods (Khairum et al., 2025). Other studies show how regional foods may be used to discuss plane and solid figures (Kartika, 2024; Aprianto et al., 2026). However, the geometric form of a food item can vary with ingredients, preparation, wrapping, cutting, and serving practices. Lemang may be approximated by a cylinder only when the cooked rice is examined outside its bamboo container and the specimen's length and cross-section support that model. A pyramid is a possible model for lappet only when the observed package has converging faces and a suitable base. Kipang and alame are better analysed through the shapes of individual pieces, their cut surfaces, thickness, and arrangement; no single solid should be assigned without documenting the specimen. These examples are provisional teaching models rather than universal descriptions of the foods.



Figure 4. Lemang, a traditional rice-based food.
Source: MediaPijar.com (2023).



Figure 5. Lappet, a traditional wrapped food.
Source: Wikimedia Commons (n.d.).



Figure 6. Alame, a traditional sweet from North Sumatra.

Source: Indozone Food (2024).

Across the reviewed object groups, the strength of the geometric evidence is uneven. Textile motifs and selected architectural components are generally suitable for analysing two-dimensional patterns, repetition, symmetry, and proportion because the relevant visual units can be isolated and compared. Keteng-keteng offers a comparatively explicit three-dimensional example because the cited study directly examines the instrument and describes its cylindrical structure (Sitepu et al., 2025). Food items require greater caution: their shapes may change during preparation, wrapping, cutting, and serving, so a geometric label should be assigned only to a documented specimen or clearly defined component. Museum-based studies likewise need to be read at the level of the specific building feature or collection object they examine. This comparison suggests that the educational usefulness of an object depends not simply on whether it resembles a familiar geometric solid, but on the quality of documentation and the clarity with which learners can identify the feature being modelled.

Mapping Objects and Geometric Elements

Table 1 differentiates geometric concepts explicitly discussed in the cited literature from provisional interpretations proposed by the present authors. The label "reported in the literature" indicates that a cited study discusses the object or concept; it does not mean that every specimen has an identical shape. "Author modelling" denotes a proposed geometric approximation that requires photographs, measurements, or field observation before it can be treated as an empirical description.

Table 1. Mapping Cultural Objects and Foods to Geometric Elements

Object/component examined	Geometric concepts	Evidence status	Source/basis of mapping
Rumah Bolon: roof outline, framework, wall surfaces, and element intersections	Lines, angles, triangles as outline approximations, rectangles, symmetry, and proportion	Reported in the studies; ideal geometric forms are approximations	Sihombing & Tambunan (2021); Mailani et al. (2024c)
Gorga: selected ornamental units, not the entire house	Triangles, circles, squares/rectangles, and polygons, depending on the motif examined	Reported; the shape should be matched to the specific motif	Sihombing & Tambunan (2021)
Ulos: individual motifs and repeated patterns	Plane figures, symmetry, translation, rotation, and reflection; dilation where supported by motif analysis	Reported in ulos studies	Basmara (2024); Mailani et al. (2024b); Gultom & Lubis (2025)
Sortopi: fabric area/component with a triangular form	Isosceles triangle and its properties	Reported	Mailani et al. (2024a)
Keteng-keteng: instrument body and end profile	Cylinder, circle, and curved surface	Reported as a cylindrical model; verify against the actual object	Sitepu et al. (2025)
Museum: selected building components and collection objects	Plane and solid figures, depending on the selected object	Reported in museum studies; not a claim about all collections	Safriyanti & Yahfizham (2023); Sagala & Hasanah (2023)

Lemang: cross-section and form after removal from the bamboo	Cylinder as an approximation; circular cross-section if observed	Author modelling; food studies provide general context	Kartika (2024); Khairum et al. (2025); direct documentation of lemang is needed
Lappet: folds/wrapping and packaged form	Pyramid or another solid only if supported by observed visual features	Author modelling; form varies with wrapping technique	Specimen description and photographs are needed
Kipang/alame: individual pieces, thickness, and arrangement	Plane figures on surfaces/cut faces; solid form depends on the specimen	Author modelling; no single form is assigned	Specimen documentation is needed
Solu bolon: boat body and hull outline	Curved lines and a preliminary solid model	Preliminary author modelling; field validation is needed	No specific supporting source is cited in the review corpus

DISCUSSIONS

This review brings together research strands that have generally been examined separately. Studies of Rumah Bolon and its ornaments focus on architectural and decorative geometry (Sihombing & Tambunan, 2021; Mailani et al., 2024c), whereas ulos studies emphasize repeated motifs and transformations (Basmara, 2024; Gultom & Lubis, 2025). Research on Sortopi identifies a triangular form in a specific component of the traditional head covering (Mailani et al., 2024a), while the keteng-keteng study provides a more direct example of solid geometry through cylindrical modelling (Sitepu et al., 2025). Museum studies extend the discussion to selected buildings and collection objects (Safriyanti & Yahfizham, 2023; Sagala & Hasanah, 2023). Food-related studies offer further contexts for discussing curved-surface solids and the geometric interpretation of food forms (Khairum et al., 2025; Kartika, 2024; Aprianto et al., 2026). The value of the present synthesis lies in comparing these strands while making clear where the evidence is direct and where it remains a teaching-oriented hypothesis.

The evidence map also reveals an important distinction between visual resemblance and culturally situated mathematical practice. A roof outline that resembles a triangle, for example, supports a geometric description of a selected two-dimensional profile; it does not demonstrate that the builders conceptualized the structure as a triangle. Similarly, identifying symmetry in an ulos motif describes a pattern relation, but it does not explain the motif's cultural significance or the knowledge of the weavers. A stronger ethnomathematics learning activity should therefore connect three forms of inquiry: close observation of the artefact, mathematical analysis of a clearly bounded feature, and contextual information about the object's use and meaning. This approach reduces the risk of reducing cultural knowledge to a collection of decorative shapes and helps prospective teachers explain both the value and the limits of mathematical abstraction.

A Case Method activity for prospective elementary teachers may be organized around the following problem: "How can a teacher guide pupils to identify and explain geometric features in a North Sumatran cultural object or traditional food without presenting an approximation as an absolute fact or overlooking its cultural context?" Working in groups, students select one object and identify relevant literature. They document an actual specimen or a reliable image, describe observable features before assigning geometric models, and—where possible—consult a knowledgeable cultural practitioner or museum source about the object's use and context. Students then distinguish direct evidence from inference, construct a simple representation, explain its limitations, and design a short learning activity for elementary pupils. Each group submits an evidence table that records the object feature, proposed geometric concept, source of evidence, and limitation of the model, followed by a brief presentation. Assessment criteria include accuracy of geometric terminology, relevance and quality of sources, clarity in distinguishing evidence from inference, cultural sensitivity, mathematical reasoning, collaboration, and communication. This proposed design is consistent with research on Case Method worksheets and learning outcomes (Fitriatien et al., 2025; Nafisah et al., 2024), but its effectiveness for the specific objects discussed here has not yet been empirically evaluated. Implementation should also consider teachers' preparation and the availability of suitable learning resources (Astuti & Rozikin, 2025).

This review has several limitations. First, its directed narrative design and reliance on accessible publications mean that it is not an exhaustive or fully reproducible systematic review. Second, the available search records do not specify exact search dates, all platform names, or a numerical screening flow, and no formal quality-appraisal instrument was applied. Third, the review did not include field documentation, specimen measurements, or consultation with cultural practitioners. Consequently, several mappings—particularly those proposed for lappet, kipang, alame, and solu bolon—remain provisional author interpretations. Future research should document representative specimens across local variations, record dimensions and preparation or construction processes, consult cultural practitioners, and test the proposed learning materials with prospective teachers and elementary pupils.

Comparative interpretation of the evidence

The cases reviewed can be compared along three dimensions: the visibility of the geometric feature, the stability of the object's form, and the availability of source-based evidence. Ulos motifs and selected Sortopi components are relatively suitable for analysing two-dimensional figures because the relevant patterns can be isolated on a textile surface. Repetition and symmetry can be examined at the level of a defined motif unit, provided that the unit and the direction of repetition are identified. By contrast, the geometry of Rumah Bolon is more dependent on the selected architectural component and viewing angle. A roof outline may be approximated by a triangle or trapezoid in a diagram, but this abstraction should not be confused with the full three-dimensional roof structure or with the building's cultural significance.

The keteng-keteng example offers a comparatively direct bridge to solid geometry because the cited study explicitly proposes a cylindrical model. Even here, the model is an idealization: natural bamboo may taper, vary in diameter, or have an irregular surface. The educational value lies partly in comparing the ideal cylinder with the physical object and discussing which properties are retained or lost in the model. Museum collections provide a different opportunity: they can expose learners to diverse artefacts, but the specific object and its documented context must be named. A broad statement that "museum collections contain cubes, cones, or prisms" is insufficient unless the relevant artefact is identified and its shape is visible or described in the source.

The food examples have the greatest need for specimen-level validation. Lemang can be modelled as a cylinder only when the cooked rice is considered separately from its bamboo casing and when the observed cross-section supports that approximation. Lappet is shaped by wrapping and preparation; a pyramid model is appropriate only for a specimen whose faces and base support that classification. Kipang and alame may vary in outline, thickness, texture, and arrangement. Treating each food as one fixed solid would erase this variation and could misrepresent local preparation practices. Thus, these examples are best presented as questions for observation rather than settled classifications. This hierarchy of evidential strength is a central result of the synthesis: not every culturally familiar object provides equally direct or stable geometric evidence.

Implications for case-based geometry learning

The proposed Case Method should begin with a problem that requires evidence-based reasoning rather than a search for a predetermined shape. For example, prospective teachers may be asked to select one documented object and answer: "Which visible features can be represented using elementary geometric concepts, and what evidence supports that representation?" The task can be organized into five stages: (1) select an object and establish its cultural and geographical context using a reliable source; (2) identify the exact component or motif to be examined; (3) record observable features from a permitted photograph, museum record, or direct observation; (4) construct and label a geometric representation while distinguishing observation from approximation; and (5) explain what the model communicates and what it leaves out. This sequence keeps mathematical abstraction connected to the source object and discourages unsupported generalization.

Assessment should reward the quality of reasoning, not merely the number of shapes identified. A suitable rubric may consider the accuracy of geometric vocabulary, the clarity of the selected unit of analysis, the credibility of the cultural source, the distinction between direct evidence and inference, the appropriateness of the model, and the explanation of its limitations. A strong student response, for instance,

would state that a selected roof outline resembles a triangle from a particular viewpoint, rather than claiming that the entire Rumah Bolon is a triangle. Likewise, a student analysing ulos should identify the specific motif and demonstrate its repeated arrangement before asserting reflectional or rotational symmetry. These criteria make cultural respect and mathematical precision part of the same learning outcome.

The design is a pedagogical proposal derived from the reviewed literature; it is not an intervention whose effectiveness has been measured in this study. The cited Case Method literature supports the relevance of case-based tasks to problem solving and critical thinking (Fitriatien et al., 2025; Nafisah et al., 2024), while research on ethnomathematics supports the broader use of cultural contexts in mathematics education (Hendriyanto et al., 2023; Kyeremeh et al., 2023; Utami et al., 2026). However, those sources do not establish that the specific activity proposed here improves learning outcomes for North Sumatran cultural objects. Its feasibility, learning impact, and cultural appropriateness should be tested in subsequent classroom or teacher-education research.

Cultural and methodological safeguards

A culturally responsive use of ethnomathematics requires more than attaching a familiar cultural label to a mathematical example. The researcher or teacher should identify whose cultural practice is being represented, where the object is used or produced, and whether the selected image or description accurately reflects local variation. North Sumatra is culturally diverse; consequently, an example associated with one Batak community or locality should not be presented as representative of every community in the province. The geographical and cultural scope of each cited study should remain visible when the findings are synthesized. This is particularly important when an object has several local names, forms, or uses, or when a motif carries meanings that cannot be inferred from its visual geometry alone.

An evidence-based progression from cultural observation to geometric abstraction

The evidence map can be translated into a progression that helps learners move from cultural observation to mathematical abstraction without treating the two as interchangeable. The first stage is contextual identification: learners establish the name, locality, use, and source of the selected object. This stage is necessary because the same broad category—such as a traditional house, textile, or food—may include different forms across communities and settings. The second stage is visual or material description. Learners record what can actually be seen, such as a repeated motif, a roof boundary, a cross-section, a fold, or a curved surface. At this point, they should avoid naming a geometric figure before describing the feature that supports the classification.

The third stage is mathematical idealization. Learners select a clearly bounded feature and compare it with a mathematical representation. For example, a textile motif may be represented by a polygon, while a bamboo instrument may be compared with a cylinder. The representation should be accompanied by a statement of the properties being retained. In the cylinder example, these might include an approximately constant circular cross-section and a curved lateral surface. If the physical object tapers or has an irregular surface, those differences should be recorded rather than concealed. The fourth stage is reflection on the model: learners identify which features have been simplified, omitted, or changed. This final step is important because mathematical modelling is not simply the act of matching an object to a familiar shape; it involves making and justifying decisions about what aspects of reality are relevant to a particular mathematical question.

This progression also clarifies how different objects may support different learning objectives. Repeated ulos motifs can be used to investigate pattern units, translation, reflection, or rotation when the relevant repetition is visible and can be traced. A selected architectural outline may support the study of line segments, angles, and approximate plane figures, while discussion of the whole building can introduce the limits of two-dimensional representation. Keteng-keteng may provide a starting point for comparing a physical object with an ideal solid. Foods are particularly suitable for tasks involving measurement, comparison, classification, and variability because preparation and serving can alter their dimensions and outlines. These are possible instructional uses inferred from the reviewed evidence; they are not claims that the present review has tested the effectiveness of each activity.

The progression can be assessed through an evidence record containing four linked elements: the source and cultural context; the observed feature; the proposed geometric representation and its supporting

properties; and the limitations of that representation. Such a record makes the reasoning visible to teachers and students. It also discourages superficial activities in which learners merely list shapes without explaining why a classification is appropriate. Assessment can therefore focus on the accuracy of observation, the justification of mathematical terminology, the fit between evidence and model, and the recognition of cultural and physical variation. This approach is consistent with the review's central distinction between findings reported in the literature and provisional interpretations introduced for teaching purposes.

For teacher education, the same progression can be used to examine the quality of learning resources before they are introduced in elementary classrooms. Prospective teachers can compare two images or descriptions of an object, identify whether they depict the same local form, and decide whether the available evidence is sufficient for a particular geometric claim. If the source does not identify the object's locality or the feature being analysed, the appropriate response is to narrow the claim or seek better documentation—not to fill the gap with assumption. In this way, ethnomathematical learning can develop mathematical reasoning alongside source evaluation, cultural attentiveness, and responsible representation.

CONCLUSION

Selected cultural objects and traditional foods of North Sumatra provide contextually meaningful opportunities to discuss points, lines, planes, angles, plane figures, solid figures, symmetry, and transformations. The reviewed literature offers the clearest object-specific support for selected Rumah Bolon components and ornaments, ulos and Sortopi motifs, keteng-keteng, and particular museum objects. Food forms such as lemang, lappet, kipang, and alame can also prompt geometric investigation, but several of these mappings remain provisional models that require specimen-level documentation. The principal contribution of this review is therefore not a claim that every cultural object corresponds to a fixed mathematical shape, but an evidence map that differentiates published findings from author-generated approximations and translates that distinction into a case-based learning proposal for prospective elementary teachers. The proposed learning design has not yet been empirically evaluated. Future research should document representative objects across local variations, consult cultural practitioners, record relevant dimensions and preparation or construction processes, and test the learning design with prospective teachers and elementary pupils.

Authors' Contributions and Responsibilities

The author(s) contributed to the conception and design of the study, literature search, analysis, interpretation, and discussion of the results. The author(s) were responsible for preparing and revising the manuscript and approved the final version for publication.

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Availability of Data and Materials

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Competing Interests

The author(s) declare no competing interests.

Generative AI Statement

Generative AI tools, including ChatGPT, were used to assist with manuscript revision, content organization, and language editing to improve clarity and readability. These tools were not used to generate research data or determine the research findings. The author(s) take full responsibility for the accuracy and final content of the manuscript.

Additional Information

No additional information is available from the author(s).

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