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Exploration of Ethnomathematics in the Tahlilan Tradition of Sungai Malaya: Geometry and Beyond

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ABSTRACT

This study aims to explore the ethnomathematical elements embedded in the cultural practice of *Tahlilan*, particularly those related to geometric concepts. The research employed a qualitative approach with an ethnographic design. The participants consisted of community members directly involved in the implementation of *Tahlilan*, with the research conducted in settings where this tradition is commonly practised. Data were collected through observation, interviews, documentation review, and a literature study. The data were then analyzed through data reduction, data display, interpretation, and conclusion drawing. The findings indicate that *Tahlilan* is a religious and social tradition passed down across generations and continues to be preserved to this day. The practice involves a series of activities, including the preparation of traditional foods, repeated recitation of prayers, distribution of food packages (berkat), and social interactions among participants. The ethnomathematical aspects identified include representations of three-dimensional geometric solids in *Tahlilan* foods, such as cylinders, cones, truncated cones, and pyramids; number patterns reflected in the sequence of days of the *Tahlilan* observance; proportionality in the distribution of food; and combinatorial structures evident in the handshaking activities among participants. These findings demonstrate a strong connection between the cultural practice of *Tahlilan* and mathematical concepts, revealing the presence of mathematical thinking within community traditions. Furthermore, this study contributes to the development of culturally based mathematics learning, particularly in the areas of geometry.

Keywords: Cultural, Ethnographic, Ethnomathematics, Geometry, Mathematical Concepts

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Introduction

Mathematics is a universal discipline that has evolved and is employed by communities worldwide, albeit in diverse ways and forms. It is often positioned as a neutral body of universal knowledge, primarily grounded in formal logic. However, ethnomathematics studies mathematical ideas, procedures, and techniques developed by distinct cultural groups, embedded in their daily activities and problem solving (Rosa & Orey, 2023). Each community has its own distinctive ways of applying mathematical concepts in everyday life, whether consciously or unconsciously. Cultural practices, religious rituals, and social

activities often incorporate complex mathematical concepts that are concealed within habitual actions and traditions passed down across generations (Batiibwe, 2024). D'Ambrosio (2020) positions ethnomathematics as the ways, styles, and modes of mathematical thinking that emerge from and respond to specific natural and socio-cultural environments, rooting it as an inherently local form of knowledge that nonetheless carries undeniable global reach. Understanding how mathematics is embedded within the cultural and social contexts of communities is, therefore, essential for bridging the gap between formal mathematics taught in schools and the informal mathematics practised in real-life situations.

In the context of contemporary mathematics education, a significant challenge remains regarding students' low interest in and understanding of mathematics. Many students perceive mathematics as an abstract and difficult subject that lacks relevance to their everyday lives (d'Entremont, 2015). Mathematics instruction that overly emphasizes formal and symbolic aspects without connecting them to students' social and cultural contexts can contribute to negative perceptions of mathematics (Kurniawan et al., 2023). As a result, students often struggle to recognize the meaning and usefulness of the mathematical concepts they learn, which in turn affects their low achievement in mathematics (Boadu & Boateng, 2024; Han et al., 2024). Research suggests that meaningful mathematics learning can be achieved when mathematical concepts are linked to students' lived experiences (Hodiyanto et al., 2024, 2025) and cultural contexts (Günay & Takunyaci, 2023). Instructional approaches that integrate cultural elements into mathematics teaching not only enhance students' conceptual understanding but also foster appreciation of their own cultural heritage. This aligns with the social constructivist perspective, which emphasizes that mathematical knowledge is not constructed solely at the individual level but is also shaped by the social and cultural contexts in which individuals are situated (Ginga & Zakariya, 2020).

The ethnomathematics approach in education has been shown to offer a wide range of benefits. Research indicates that when teachers integrate elements of local culture into mathematics instruction, students demonstrate increased learning motivation, stronger conceptual understanding, and more positive attitudes toward mathematics (Acharya et al., 2021; Villarin et al., 2024; Wulandari et al., 2024). Cultural activities such as traditional food preparation and community economic practices embody concepts of geometry, measurement, and calculation, which can be connected to institutional mathematics through ethnomathematical linkages (C. Rodríguez-Nieto et al., 2019; C. A. Rodríguez-Nieto, 2021; Taneo et al., 2025). Traditional fishing activities can also be mathematically modelled to meaningfully teach concepts of measurement, proportion, and economic aspects (Mansilla et al., 2023; Sudirman et al., 2024). The use of local cultural contexts and language enhances mathematical literacy, supports students' understanding of geometry, and promotes meaningful learning experiences (Quispe & Janto, 2022; Umbara et al., 2023). Furthermore, this approach contributes to the preservation of local culture by encouraging students to

appreciate and understand the mathematical wisdom embedded in their cultural practices (Kurniawan et al., 2023; Sunzuma & Umbara, 2025; Wulandari et al., 2024). Ethnomathematics, therefore, serves a dual role: as a pedagogical tool to improve mathematics learning and as an instrument for cultural preservation. It enables the development of more inclusive contextual learning that values local cultural backgrounds and bridges the gap between scientific knowledge and local wisdom. This approach also enriches instructional practices by introducing cultural, social, and spiritual values into students' learning experiences in mathematics.

Indonesia, a country with exceptionally rich cultural diversity, provides an ideal context for exploring ethnomathematics. Each region in Indonesia has unique cultural practices and traditions that embody mathematical concepts. However, the potential of this cultural wealth has not yet been fully utilized in mathematics learning in schools (Batiibwe, 2024; Payadnya et al., 2024). Most mathematics instruction remains heavily centred on textbooks that employ contexts unfamiliar to students, thereby reducing the meaningfulness of learning. However, if teachers can identify and integrate local cultural practices that incorporate mathematical ideas, learning can become more relevant and meaningful for students. Learning becomes meaningful when it is connected to students' everyday lives, and local wisdom is frequently encountered in their daily experiences; therefore, learning will be more meaningful when integrated with ethnomathematics (Rodríguez-Nieto, 2021; Rodríguez-Nieto & Escobar-Ramírez, 2022).

Tahlilan is a religious tradition widely practiced among Indonesian Muslims, especially on the island of Java and in several other regions such as West Kalimantan. From an ethnomathematical perspective, *Tahlilan* serves as an example of how Islamic values and social structures can be analyzed through a mathematical lens, including quantitative aspects, spatial organization, and the timing of implementation, as demonstrated in the study by Firdaus and Hodiyanto (2019) on Islamic ethnomathematics in the saprahan tradition. Although *Tahlilan* has been practiced for centuries and has become an integral part of the socio-religious life of Indonesian Muslim communities, the ethnomathematical dimensions of this tradition have received limited scholarly attention.

Several studies have examined Tahlilan from socio-religious perspectives (Hidayat et al., 2024; Mandala et al., 2025; Nasir, 2019; Sobhan et al., 2023; Toyibah et al., 2025). A number of studies have also begun to explore its mathematical dimensions: Narawati et al. (2019) identified concepts of counting and multiples in Tahlilan activities in Pacitan; Richardo et al. (2020) examined Islamic cultural practices broadly through a library study, noting their potential for mathematics learning; and Sari and Fahmy (2022) analyzed the Javanese Tahlilan tradition using modular arithmetic, focusing specifically on day-counting and the pasaran calendar system. However, these studies share a common limitation — each examines only a single or narrow mathematical concept, and none has simultaneously analyzed the

geometric, numerical, proportional, and combinatorial dimensions of Tahlilan within a single integrated ethnographic framework. This constitutes the primary research gap: the absence of a comprehensive, multi-dimensional ethnomathematical analysis of the Tahlilan tradition grounded in direct fieldwork. Besides that, most ethnomathematics research in Indonesia has concentrated on material cultural artefacts such as batik, traditional architecture, weaving, wedding, and handicrafts (Abdullah et al., 2025; Dominikus et al., 2023; Hodiyanto et al., 2022; Iffah et al., 2025; Prahmana & D'Ambrosio, 2020; Zuliana et al., 2023).

The novelty of this study can be identified on three levels. First, analytically: unlike previous studies that examined Tahlilan from a single mathematical concept such as counting (Narawati et al., 2019) or day-counting (Sari & Fahmy, 2022), this study simultaneously analyzes four distinct mathematical structures - two- and three-dimensional geometry, number patterns, proportionality, and combinatorics — within one integrated framework. Second, methodologically: grounded in Rodríguez-Nieto & Escobar-Ramírez (2022) ethnomathematics framework, which conceptualizes mathematical knowledge as culturally situated and community-generated, this study employs ethnographic fieldwork including participant observation, semi-structured interviews, and documentation to ensure mathematical interpretations reflect the emic perspective of the Sungai Malaya community. Third, theoretically: by demonstrating that a single ritual practice simultaneously embodies multiple mathematical domains, this study advances ethnomathematics research into Islamic ritual practices and provides a foundation for developing contextual mathematics learning materials in Indonesia.

Based on the description above, this study aims to explore the ethnomathematics embedded in the practice of *Tahlilan* in Sungai Malaya, Kubu Raya Regency, West Kalimantan, and to identify the geometric concepts involved in the implementation of this ritual. In addition, significant concepts beyond geometry are also reported in this study as supplementary findings. This research is expected to contribute to the development of contextual and meaningful mathematics learning for students, while also supporting the preservation and appreciation of local wisdom within the community as was done in previous research by combining ethnomathematics (regional food specialties) in geometry learning (Hodiyanto, Setyaningsih, et al., 2026; Hodiyanto, Aprida, et al., 2026). Furthermore, this study is anticipated to pave the way for further research on ethnomathematics in the context of religious practices and other social rituals in Indonesia.

Methods

Research Design

This study employed a qualitative research design with an ethnographic approach, aiming to explore the mathematical practices embedded in the Tahlilan tradition of the Sungai Malaya community. An ethnographic approach was chosen because it allows researchers to understand the meaning, patterns, and structures of cultural activities as they naturally occur in community life, rather than imposing external interpretations (Cohen et al., 2018; Rodríguez-Nieto & Escobar-Ramírez, 2022). The researcher assumed the role of a participant observer — actively attending Tahlilan rituals while simultaneously documenting mathematical patterns as they emerged within their cultural context. This design enabled the researcher not only to study the Tahlilan tradition as an object of inquiry but also to learn from it as a source of meaningful mathematical knowledge grounded in the community's own practices.

Informants and Location

This study was conducted in Sungai Malaya Village, Kubu Raya Regency, West Kalimantan, Indonesia, where the Tahlilan tradition remains an active and regularly practiced communal ritual. Participants were selected using purposive sampling, with the following criteria: (1) active participation in Tahlilan rituals, (2) adequate knowledge of the cultural and religious meanings of the tradition, and (3) willingness to be interviewed. A total of two participants were involved in this study, all of whom are religious leaders who have extensive knowledge of and active roles in the Tahlilan tradition in the Sungai Malaya community.

Instruments and Data Collection

Data were collected through three methods: participant observation, semi-structured interviews, and documentation. First, participant observation was conducted by attending Tahlilan rituals to directly record the repeated recitations, the number and arrangement of food offerings, and other mathematical structures that emerged. An observation guide was developed based on D'Ambrosio's (2020) ethnomathematics framework, focusing on indicators of mathematical activity including counting, measuring, locating, designing, and pattern recognition. Field notes were used to document the atmosphere, interactions, and ritual structure in detail. Second, Second, semi-structured interviews were conducted with the two religious leader participants to explore the activities carried out during the Tahlilan ritual. The interviews focused on identifying the sequence of activities, the roles of participants, and the practices commonly performed throughout the event. Third, documentation was performed through photographs, recordings of the prayer sequence, documentation of food arrangements, and collection of written or oral information related to the Tahlilan tradition. To ensure the credibility and trustworthiness of the findings, this study employed methodological triangulation through participant observation and

semi-structured interviews. The observation data were compared with interview data from the religious leader participants to verify the consistency of information regarding the activities carried out during the Tahlilan ritual.

Data Analysis

Data analysis followed the interactive model proposed by Miles et al. (2014), consisting of three concurrent stages: data condensation, data display, and conclusion drawing and verification. In the data condensation stage, data from observations, interviews, and documentation were selected, focused, and organized to identify recurring patterns in the Tahlilan ritual. In the data display stage, the condensed data were arranged systematically to enable identification of mathematical concepts — including geometric forms, number patterns, proportionality, and combinatorial relationships — embedded within the ritual practices. Finally, in the conclusion drawing and verification stage, the researcher interpreted the connections between these cultural patterns and formal mathematical concepts, with conclusions verified through triangulation to ensure their credibility.

Results and Discussion

The *Tahlilan* tradition encompasses various structured activities and cultural artefacts that exhibit mathematical patterns, ranging from the geometric forms of traditional foods to the repetitive sequence of prayers, temporal scheduling patterns, and the arrangement of participants' seating. Although community members may not consciously apply formal mathematical concepts, these practices demonstrate that mathematics is inherently embedded within cultural activities (D'Ambrosio, 2020; D'Ambrosio & Rosa, 2017). Consequently, the *Tahlilan* tradition offers a compelling context for examining the interrelationship between culture and mathematical concepts that are embedded in everyday life.

The foods served during the *Tahlilan* ceremony in Sungai Malaya extend beyond their function as mere dishes; they embody a variety of mathematical elements that can be examined through an ethnomathematical lens. Based on the research data, these traditional foods possess physical forms corresponding to specific geometric shapes, demonstrate consistent measurements, reveal distribution patterns, and display structures that can be analyzed mathematically. These mathematical elements emerge naturally through cultural practices rather than through formal instruction, aligning with a recent study by Batiibwe (2024), which identifies universal mathematical activities (counting, measuring, designing, locating, playing, and explaining) that are manifested across diverse cultural contexts. The mathematical elements identified in *Tahlilan* foods can be classified into five main categories: (1) geometric forms (two-dimensional and three-dimensional), (2) number patterns, (3) proportionality concepts, (4) set theory, and (5) applications of combinatorics. This classification framework offers a systematic approach to

understanding how mathematical thinking is embedded in the practices of food preparation and presentation.

Geometric Elements in the *Tahlilan* Tradition

Two-Dimensional Geometric Shapes in Traditional Foods

Analysis of traditional foods reveals distinct two-dimensional geometric patterns when viewed from specific perspectives. Table 1 presents the two main two-dimensional geometric shapes identified in *Tahlilan* foods.

Table 1. Two-Dimensional Geometric Shapes in *Tahlilan* Food

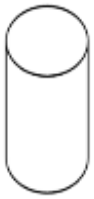
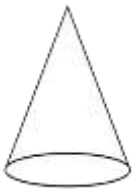
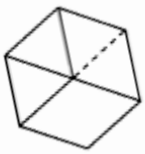
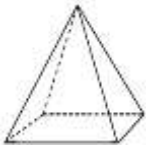
Geometry Concept	Names of Food	Mathematical Characteristics
Circle	 Apem	The top view shows a perfect circle. The natural distribution of the dough during cooking produces a radially symmetrical pattern with a relatively uniform radius r.
Circle	 Kocor	The surface exhibits a flat circular geometry. The natural dispersion of the dough creates a circular shape with a nearly uniform radial distribution, embodying the mathematical properties of a circle with a constant centre and radius.
Rectangle	 Lupis	When viewed from above, lupis displays rectangular geometry. The wrapping process creates opposite sides that are equal and parallel, which shows the basic properties of a rectangular plane shape.

The appearance of circular and rectangular shapes in traditional food preparation reflects what Ascher (2018) described as the universal presence of geometric thinking in cultural practices. These shapes are not arbitrary but rather the result of optimization principles embedded in traditional knowledge—circles maximize area for a given circumference (relevant for even cooking). At the same time, rectangles facilitate efficient wrapping and storage.

Three-Dimensional Geometric Space Structures in Traditional Foods

Three-dimensional analysis revealed more complex geometric structures in the *Tahlilan* food. Table 2 presents the identification of geometric shapes.

Table 2. Three-Dimensional Geometric Shapes in *Tahlilan* Food

Geometry Concept	Names of Food	Mathematical Characteristics
Cylinder	  **Leppet**	Leppet has an elongated cylindrical shape. The uniformly wound leaf sheath forms a circular base and a consistent height, resembling a tube.
Cone	  **Nasi Pettok**	Nasi Pettok is shaped into a cone, resembling a small tumpeng. This shape features a circular base and a single apex, adhering to the fundamental characteristics of a cone.
Cone	  **Nasi Rebbe**	Arranged in a cone shape with the peak as the meeting point of the sides, showing conformity with the conical geometric shape.
Conical frustum	  **Nasi Rebbe**	In some servings, the top of the rebbe rice is flattened to form a truncated cone with two distinct circles as the base.
Quadrilateral Prism	  **Topa'**	The topaz has the shape of a rectangular prism, because its base and top are both rectangular and its sides are perpendicular, forming a geometric shape with a uniform height. There is no vertex like a pyramid.
Pyramid	  **Kallinti**	Forming a small pyramid structure that demonstrates the properties of a pyramid with a polygonal base and triangular lateral sides that meet at the apex.

The diversity of three-dimensional shapes found in traditional foods demonstrates that mathematical knowledge can be crystallized in cultural artefacts (Jaizul & Putra, 2025). The systematic production of cylinders, cones, and prisms in food preparation suggests an implicit mastery of spatial geometry and the concept of volume, transmitted through cultural practices rather than formal education.

From a pedagogical perspective, the use of ethnomathematics based on the *Tahlilan* tradition can specifically support students' mastery of two-dimensional and three-dimensional geometric concepts through meaningful and contextual learning experiences. The foods served during *Tahlilan*, which take the forms of circles, rectangles, cylinders, cones, truncated cones, quadrilateral prisms, and pyramids, provide concrete representations of plane and solid figures. Such tangible representations facilitate students' visual and spatial engagement, which has been empirically shown to enhance geometric understanding (Purba & Nurwijaya, 2024; Wulandari et al., 2024). The incorporation of local cultural objects into geometry instruction, such as traditional foods in *Tahlilan*, aligns with research indicating that cultural contexts support students' ability to identify and understand geometric shapes in educational settings. The use of familiar cultural artifacts enables students to recognize properties of plane figures—such as symmetry, radius, diameter, perimeter, and area—as well as relationships between two-dimensional and three-dimensional representations. This approach helps bridge abstract geometric concepts and real-life experiences, making geometry learning more accessible and meaningful to students (Kesumawati et al., 2025; Zainovi et al., 2025).

Furthermore, the representation of three-dimensional geometry in *Tahlilan* foods—such as cylindrical leppet, conical Nasi Pettok and Nasi Rebbe, truncated cones in certain presentations of Nasi Rebbe, quadrilateral prisms in Topa', and pyramidal kallinti—provides opportunities for students to explore spatial relationships, volume, surface area, and structural properties of solid figures. Previous studies have demonstrated that learning activities integrating cultural contexts and three-dimensional objects significantly enhance students' spatial visualization skills, which are critical for understanding solid geometry (Jainuddin & Herman, 2025). In addition, ethnomathematics-based geometry learning has been shown to improve student engagement, motivation, and conceptual understanding by situating mathematics within culturally relevant practices. Systematic reviews and empirical studies indicate that the integration of ethnomathematical contexts in geometry instruction strengthens students' ability to connect mathematical ideas with everyday life, thereby fostering deeper conceptual comprehension and sustained learning outcomes (Kyeremeh et al., 2023; Pradana et al., 2022)

Overall, the findings of this study suggest that foods in the *Tahlilan* tradition are not merely cultural artifacts but also embody rich two-dimensional and three-dimensional geometric structures. As such, *Tahlilan*-based ethnomathematics can serve as a valuable pedagogical resource for geometry instruction,

enabling students to connect formal geometric concepts with their cultural experiences. This approach supports the development of contextual and meaningful geometry learning while reinforcing the relevance of mathematics within local cultural practices.

Other Mathematical Elements in the *Tahlilan* Tradition

Beyond geometric shapes, the *Tahlilan* tradition encompasses various mathematical elements that emerge naturally in everyday cultural practices. Activities such as prayer repetition, food classification, seating arrangements, food distribution, and handshake rituals demonstrate that mathematics is an integral component of social activities, often practised unconsciously by community members. This section presents a mathematical analysis based on research findings.

Number Patterns in the Temporal Structure of *Tahlilan*

Tahlil ceremonies are held on specific commemorative days after death, namely: T = {1, 2, 3, 4, 5, 6, 7, 40, 100, 365, 1000}. This sequence represents the temporal set that structures the ritual calendar. While not following an arithmetic or geometric progression, this structure demonstrates the community's use of a number system to mark distinctive phases in the process of commemorating the deceased. Mathematically, this reflects a non-uniform sequence—an ordered set without constant difference but structured according to cultural rules and religious significance.

The temporal structure can be analyzed through the lens of symbolic numerology and cultural mathematics. The sequence begins with shorter intervals (1, 2, 3, 4, 5, 6, 7) representing periods of immediate mourning, transitions through intermediate markers (40, 100), and extends to longer-term commemoration (365, 1000). This pattern reflects what Barton (2008) described as an ethnomathematical time-reckoning system that prioritizes cultural and religious significance over mathematical uniformity. Although this sequence does not conform to formal arithmetic or geometric sequences, it provides evidence that traditional ritual temporal systems contain significant mechanisms of numerical categorization. Consistent with Batiibwe's analysis (Batiibwe, 2024), the temporal system in local cultures is not merely a mathematical construct but is constructed through symbolic interactions, belief systems, and social functions. The irregularity itself carries meaning: shorter intervals are clustered at the beginning when grief is most acute, while longer intervals reflect the gradual integration of loss into ongoing life.

Food Distribution as a Concept of Proportionality

This represents the fundamental concept of proportionality. Although community members do not engage in formal calculations, they understand that fair distribution must consider the balance between the quantity of food and the number of guests. This reflects an intuitive understanding of the concepts of ratio and division. Research by Mansilla-Scholer et al. (2022) demonstrates that traditional activities, such as fishing, also involve mathematical modelling to teach measurement and proportion. In the context of

Tahlilan, food distribution involves not only simple sharing but also considerations of social hierarchy (e.g., larger portions for religious figures or elders), managing leftovers when m is not perfectly divisible by n, and making dynamic adjustments based on the actual versus anticipated number of participants.

Figure 2. Serving Food at *Tahlilan* Events

Figure 2 illustrates the process of serving food at a *Tahlilan* event, where each guest receives a dish prepared by the host. The distribution process involves several mathematical considerations: (1) Direct Proportion: As the number of participants increases, individual portions decrease (assuming a constant quantity of food), (2) Inverse Proportion: More food packages allow for larger portions per person, (3) Leftover Management: When m is not perfectly divisible by n, communities use culturally specific strategies to handle leftovers—some prioritize the elderly, others distribute evenly and then share the remaining portions. Food distribution during a *Tahlilan* (religious gathering) demonstrates a practical application of proportional reasoning. If there are m food packages and n participants, the ideal portion each person receives can be formulated as Equation (2).

$$P = \frac{m}{n} \tag{2}$$

Handshaking Activity as an Application of Combinatorics

The activity of shaking hands is carried out by all those present at the *Tahlilan* event, as shown in Figure 2. Guests who have just arrived will shake hands with guests who have been waiting at the *Tahlilan* location.

Figure 3. Shaking Hands at the *Tahlilan* Event

The tradition of shaking hands after *Tahlilan* (religious prayer) demonstrates an interaction pattern that can be explained using combinatorial concepts. If there are n participants, the total number of handshakes that occur can be calculated using the combinatorial formula for two objects, as shown in Equation (3).

$$S = \binom{n}{2} = \frac{n(n-1)}{2} \tag{3}$$

This formula demonstrates that each participant will shake hands with every other participant exactly once. This phenomenon demonstrates that social interactions have a mathematical structure that can be analyzed. This representation aligns with the mathematical model used in the Handshake Problem, a common pedagogical strategy used to introduce the concepts of combination and generalization of patterns (Cifarelli, 2021; Ryandi et al., 2018). Social phenomena like this demonstrate that mathematical structures can emerge in cultural practices without the participants being aware of them. This formula demonstrates quadratic growth—when the number of participants doubles, the number of handshakes quadruples. To put this into context, in a *Tahlilan* (religious gathering) with 20 participants, 190 handshakes occur; with 30 participants, the number increases to 435. Understanding this nonlinear growth is important in various mathematical and applied contexts, such as network theory and algorithmic complexity.

An ethnomathematical analysis of *Tahlilan* offers several pathways to improving mathematics education: (1) Culturally responsive pedagogy, where teachers can utilize the *Tahlilan* context to introduce geometric concepts (2D and 3D shapes), number patterns, proportional reasoning, set theory, coordinate systems, and combinatorics. This approach makes mathematics learning more meaningful and relevant for Muslim students in Indonesia, potentially reducing math anxiety and increasing engagement; (2)

Connecting informal and formal mathematics, where explicit connections between *Tahlilan* practices and formal mathematical concepts can help students recognize that mathematics is not foreign or abstract but connected to their lived experiences. This bridging process supports conceptual understanding by providing concrete referents for abstract ideas; and (3) Project-based learning, where students can conduct ethnomathematical investigations within their own communities, documenting mathematical practices in religious ceremonies, traditional crafts, architectural designs, or commercial activities. This approach develops research skills while fostering a more profound cultural appreciation.

It is worth noting that this type of research is important because it helps teachers and students of mathematics and other sciences to improve their understanding of two-dimensional and three-dimensional geometric figures by considering ethnomathematical connections. Furthermore, it can strengthen lesson plans by leveraging the power of everyday practices familiar to students and promote a more fruitful STEAM education with meaningful learning (Olivero-Acuña et al., 2025; C. A. Rodríguez-Nieto et al., 2025). The aim is to mitigate the difficulties students face when dealing with geometric figures, which has often been due to the training acquired by their teachers, since they do not address the construction, properties, and relationship of these figures with the environment.

Integrating ethnomathematical content derived from *Tahlilan* practices into mathematics instruction offers several advantages. First, the *Tahlilan* context is highly familiar to Muslim students in Indonesia, which may reduce mathematics anxiety and increase student engagement in learning (Massarwe et al., 2012). The geometric shapes of traditional Tahlilan foods — circular apem, cylindrical wajik, and conical tumpeng — can serve as concrete manipulatives for introducing two- and three-dimensional geometry, allowing students to measure, calculate surface area, and compare volumes using real cultural objects rather than abstract textbook figures. Second, incorporating religious contexts may provide a spiritual dimension in mathematics learning, potentially enhancing students' intrinsic motivation (Sunzuma & Maharaj, 2021). Third, this approach may help students recognize that mathematics is not foreign or separate from their lives but rather an integral part of the social and religious practices they engage in daily. Fourth, such exploration may contribute to the preservation of the *Tahlilan* tradition by fostering a deeper understanding of the mathematical structures and organizational principles that underlie the practice.

Conclusion

This study demonstrates that the *Tahlilan* tradition contains rich and diverse mathematical structures, particularly in relation to two-dimensional and three-dimensional geometric concepts reflected in the shapes of the foods served. Various traditional foods represent plane figures such as circles and

rectangles, as well as solid figures including cylinders, cones, conical frustums, rectangular prisms, and pyramids. These geometric representations emerge naturally through the processes of food preparation, wrapping, and presentation, reflecting the application of mathematical concepts embedded in the community's cultural practices. In addition to geometric concepts, *Tahlilan* activities also reveal other important mathematical findings. The implementation of *Tahlilan*, which is carried out based on a specific sequence of days (such as the 3rd, 7th, 40th day, and so on), reflects concepts of number patterns and numerical regularity. The distribution of food to participants demonstrates the application of proportionality and fair division, while the practice of handshaking among congregants represents combinatorial structures related to the number of possible interaction pairs.

The Tahlilan tradition thus functions not merely as a religious and social ritual but as a rich ethnomathematical space in which geometry, number patterns, proportionality, and combinatorics are simultaneously embedded and enacted through cultural practice. These findings extend ethnomathematics research into the domain of Islamic ritual practices — a context previously underrepresented in the literature — and provide a foundation for developing contextual mathematics learning materials aligned with Kurikulum Merdeka's P5 framework, contributing to culturally responsive mathematics education in Indonesia.

This study has two main limitations. First, with only two religious leader participants from a single village, the findings cannot be generalized to other communities where Tahlilan is practiced, as variations in local customs and ritual structures may yield different mathematical patterns. Second, the absence of women participants — who are primarily responsible for food preparation — represents a significant sampling gap, as they are most directly engaged with the geometric and proportional aspects of the tradition.

Recommendations

Future studies are recommended to empirically examine the implementation of *Tahlilan*-based ethnomathematics in classroom instruction, particularly to measure its effects on students' understanding of two-dimensional and three-dimensional geometry, number patterns, proportional reasoning, and combinatorics. Experimental or quasi-experimental research designs may be used to compare the effectiveness of ethnomathematics-based instruction with conventional mathematics instruction. In addition, further research may expand the scope of investigation to other aspects of *Tahlilan* activities, such as the rhythm of prayer recitations, the sequence of ritual activities, and social interactions among participants. Comparative or cross-cultural studies of *Tahlilan* practices across different regions are also recommended to provide a more comprehensive understanding of the variations in the mathematical

structures embedded in cultural traditions. Future research may also focus on developing instructional materials, learning modules, and teaching media based on *Tahlilan* ethnomathematics, in both printed and digital formats. Such efforts are expected to support contextualised mathematics learning, preserve local wisdom, and enhance the relevance of mathematics education to students' social and cultural lives.

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