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Ethnomathematical Knowledge Embedded in the Banua Oge Traditional House: A Cultural Analysis Through Bishop's Fundamental Mathematical Activities

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Abstract

Mathematics is frequently perceived by students as abstract, difficult, and disconnected from everyday experiences, resulting in diminished engagement and limited conceptual understanding. Although integrating cultural contexts into mathematics instruction has been widely acknowledged as an effective strategy for enhancing learning meaningfulness, studies that systematically utilize local architectural heritage, particularly the Banua Oge traditional house in Palu City, as a foundation for designing contextualized mathematics learning remain scarce. Accordingly, this qualitative study, employing an ethnographic approach, investigates the geometric and mathematical elements embedded in the architectural structure of the Banua Oge traditional house to inform the development of culturally grounded mathematics learning materials. Data were collected through participant observations, documentation, and semi-structured interviews with cultural experts, and were analyzed using the interactive model of Miles and Huberman, encompassing data condensation, data display, and conclusion drawing. The findings demonstrate that the architectural features of the Banua Oge embody diverse mathematical concepts, including two-dimensional geometric figures, numerical concepts, spatial configurations, and Alan Bishop's fundamental mathematical activities. These findings highlight the potential of local cultural heritage as a meaningful ethnomathematical resource for bridging formal mathematical concepts with students lived experiences. Finally, this study offers a culturally responsive pedagogical framework that supports teachers in designing mathematics instruction that is more contextual, engaging, and relevant, while contributing to the advancement of ethnomathematics and culturally grounded mathematics education.

Keywords: Geometrics Elements; Traditional Houses; Banua Oge; Ethnographic Approach

Introduction

Math lessons are usually less in demand by students because they are considered boring and difficult lessons. In line with the opinion (Syifa & Gumala, 2025). Unconsciously, Mathematics plays an important role in various fields of science, at it is indispensable in daily life. Math can solve problems and solve them, but only by using existing rules so that mathematics is needed anytime and anywhere (Angraini et al., 2023). Mathematics subjects are trusted by students as monotonous and difficult subjects to understand. Math becomes more fun with a variety of resources that that are obtained through concrete things and involve everyday life (Mellawaty et al., 2023).

Mathematics and culture are two interrelated elements. Values mathematics is related to the nature of mathematics, derived from the way mathematicians of various culture develop mathematics (Bishop, 1999). Application of mathematics used in many areas of human life such as economics, politics, and culture (Novalena & Listiani, 2022). In fact, cultural heritage shows structure, patterns, symmetry, shapes, and measurement concepts that reflect the principles mathematics that has developed naturally in local culture (Hidayati et al., 2025). Relate math material to social, cultural, and experiential contexts students are needed so that the learning process feels more meaningful and in accordance with their lives (Khapsari et al., 2025). In the relationship between the application of mathematics and the culture of a certain group in society is called ethnomathematics. In this case, the ethnomathematical approach emerged as one of the creative solutions that combines mathematical concepts with local culture and everyday life.

Ethnomathematics is a related or connected culture with mathematics and its relationship to everyday life, it discusses how mathematics contributes to cultural activities (Sari et al., 2023; Putra & Ramdhani, 2025). Ethnomathematics reconstructs mathematics so that it is rooted in mathematical knowledge built by concepts, methods, and techniques used by cultural groups in dealing with problems of daily life make mathematics closer to the student and easier to understand (D'Ambrosio, 1985). In 1999, Bishop said that mathematics is a culture, which is integrated in all aspects community life (Turmuzi, 2022). Ethnomathematics is important because this research is about how people use mathematical algorithms to solve the world's problems from their own mathematical point of view (Syifa & Gumala, 2025).

Culture-based math learning is deeply rooted in community culture in which mathematics is learned and used (Patri & Heswari, 2022). Ethnomathematics recognizes that mathematics exists in one's cultural practices and can used to contextualize mathematics (Laukum et al., 2024). This ethnomathematics helps to foster a deeper appreciation of heritage diverse cultures while improving critical thinking and solving skills problems with applying abstract mathematical concepts in relevant cultural contexts (Kho et al., 2025). One of the primary goals of ethnomathematics is to foster students' critical thinking, mathematical reasoning, and problem-solving abilities by situating mathematical learning within meaningful sociocultural contexts. Through this approach, students are encouraged to recognize mathematics as an integral part of everyday life rather than as an abstract body of knowledge detached from their lived experiences, particularly within their own cultural practices. Culture encompasses the shared beliefs, values, customs, traditions, and practices that evolve within a community and are sustained across generations. As a dynamic system of inherited knowledge and social practices, culture embodies meaningful values that shape how individuals interpret, organize, and engage with their surrounding world. Therefore, cultural practices provide authentic contexts through which mathematical ideas can be explored, constructed, and understood, thereby reinforcing the relevance of mathematics in real-life situations and supporting the broader objectives of ethnomathematics (Novalena & Listiani, 2022).

Central Sulawesi is widely recognized as the Land of a Thousand Megaliths, reflecting its rich concentration of megalithic heritage that has contributed significantly to the historical development of science, culture, and civilization in the region. In addition to its renowned archaeological legacy, Central Sulawesi possesses a wealth of indigenous cultural heritage, one of which is the Banua Oge, the traditional house of the Kaili people in Palu City. Preserved and transmitted across generations, Banua Oge represents an enduring expression of the Kaili community's cultural identity, local wisdom, and accumulated knowledge. Traditional houses are not merely physical structures but also cultural symbols that embody the distinctive characteristics, worldview, and intellectual achievements of a society, reflecting the exploration and evolution of human thought (Wikaningtyas et al., 2022). According to Purba et al. (2023), a traditional house is one of the representations the best culture in a tribal community or society. A Traditional House of the Continent was the house used by the nobles and the royal family (Muhammad et al., 2021).

There are several research results on ethnomathematics in traditional houses among them are the results of research from Wardhani et al. (2022), which show that there is a the concept of geometry consisting of flat shapes (rectangles,) and spatial shapes (prisms) triangles and blocks) on the traditional house of the Muna tribe in Southeast Sulawesi. In addition, the results research obtained from the research of Tyas et al. (2022), shows that the existence of awakening in Mathematics on Ornaments and Decorative Patterns in Selaso Traditional House twin falls in Riau consist of square, rhombus, rectangle, and triangle and the carving motifs on the traditional house also apply the concept of symmetrical, unity, and geometric transformations in mathematics and the application of flat shapes such as triangles and semicircle. Furthermore, the results of the research of Wikaningtyas et al. (2022) which shows that there is a geometric concept contained in the design of the building Arik traditional houses in Jambi include the concept of flat triangles and squares (rectangular and rectangular). Isoscele trapezoid), the concept of building a flat-sided space (octagonal prism), the concept of relationships between lines (horizontal and vertical), as well as geometric transformations (reflection and translation). The research conducted by Muhammad et al. (2021), only explains the definition of the Banua traditional house while research from Damayanti et al. (2025), only explain the use of learning media in the Palu traditional house security system.

Despite the growing body of research in ethnomathematics, a significant gap remains in the literature, as no previous study has comprehensively examined the mathematical elements and cultural meanings embedded in the Banua Oge traditional house as a resource for advancing mathematics education and scientific knowledge. Identifying the mathematical concepts inherent in this important cultural artifact of the Kaili people enables students to recognize that mathematical ideas are deeply embedded within their own cultural heritage rather than existing solely as abstract concepts learned in classrooms. Such an approach encourages teachers to move beyond formal, decontextualized instruction by integrating informal mathematical experiences derived from authentic cultural objects found in students' surrounding environments. Learning activities grounded in culturally relevant contexts have been shown to increase students' engagement, participation, and appreciation of mathematics by strengthening the connection between academic concepts and their lived experiences (Larasati et al., 2025). Accordingly, this study aims to analyze the geometric elements embedded in the Banua Oge traditional house in Palu City through the lens of Alan Bishop's framework. The findings are expected to provide an empirical foundation for the development of culturally responsive geometry teaching materials that integrate local cultural heritage into mathematics instruction, thereby enriching students' conceptual understanding while promoting the preservation of indigenous knowledge through education.

Methods

This study employed a qualitative research design with an ethnographic approach to explore the ethnomathematical knowledge embedded in the Banua Oge traditional house of the Kaili people. Qualitative research seeks to understand and interpret the meanings that individuals or groups attribute to social and cultural phenomena within their natural settings (Creswell, 2012). Accordingly, the ethnographic approach was considered appropriate because it enabled an in-depth investigation of the cultural values, architectural knowledge, and mathematical ideas embodied in the Banua Oge through direct engagement with the local community and its cultural heritage. The study was conducted over a three-month period, during which the researchers immersed themselves in the cultural setting and collaborated closely with local cultural custodians responsible for preserving the traditional house. This prolonged engagement facilitated a comprehensive understanding of the architectural structure, indigenous terminology, symbolic meanings, and mathematical concepts embedded within the building, including geometric forms, numerical relationships, spatial organization, and traditional measurement systems.

Data Collection

The study utilized primary data collected through three complementary techniques: semi-structured interviews, participant observations, and documentation. The interview involved one key informant, Mr. Mehdi Datupalinge, a recognized cultural expert who possesses extensive knowledge of the history, philosophy, and architectural characteristics of the Banua Oge traditional house that has been transmitted across generations. His expertise provided rich contextual information regarding the cultural meanings and construction principles underlying the building.

Participant observations were conducted directly at the Banua Oge traditional house located in Lere Village, West Palu District, Palu City, Central Sulawesi, Indonesia. As the former royal residence of the Kaili nobility, Banua Oge is characterized by its monumental wooden stilt-house architecture and is officially designated as a protected cultural heritage site. Beyond its architectural significance, the house remains an important symbol of Kaili cultural identity, with its preservation sustained through the active participation of local cultural custodians and the surrounding community. The site was selected because its architectural features, including the geometric configuration of the tiered roof, the proportional arrangement of wooden pillars, the spatial organization of interior and exterior spaces, and the traditional construction measurements, embody rich indigenous mathematical knowledge that has been preserved through generations. These characteristics make the Banua Oge an appropriate setting for ethnomathematical investigation.

Documentation was employed to complement the interview and observational data by collecting written records, field notes, photographs, architectural sketches, audio recordings, and video recordings. These materials served to strengthen data credibility through triangulation and provided detailed evidence for interpreting the mathematical and cultural elements identified throughout the study.

Data Analysis

The collected data were analyzed using the interactive qualitative data analysis model proposed by Miles et al. (1994), which comprises three iterative stages: data condensation, data display, and conclusion drawing/verification. Data condensation involved selecting, simplifying, organizing, and transforming the raw data to focus on information relevant to the research objectives. Subsequently, the condensed data were systematically presented through data displays to facilitate interpretation, comparison, and pattern identification. Finally, conclusions were continuously verified against the collected evidence to ensure the credibility, consistency, and trustworthiness of the findings.

To identify the ethnomathematical characteristics embedded in the Banua Oge traditional house, the analysis was further guided by Alan Bishop's framework of six fundamental mathematical activities. This analytical framework enabled the researchers to examine how mathematical thinking is manifested through the cultural practices associated with the traditional house, including counting, measuring, locating, designing, playing, and explaining. Within this framework, counting and measuring represent numerical and quantitative reasoning, locating and designing relate to geometric and spatial reasoning, while playing and explaining reflect the social, cultural, and communicative dimensions through which mathematical knowledge is constructed, transmitted, and preserved across generations. The integration of Bishop's framework therefore provided a systematic theoretical lens for interpreting the mathematical concepts embedded within the architectural and cultural features of the Banua Oge.

The data analysis technique used refers to the qualitative data analysis of the model (Miles et al., 1994), that is data condensation, which is the activity Simplifying data until it reaches the research objective, data display namely the systematic presentation of data so that it is easy to understand, conclusion drawing or verification is the drawing of conclusions from the results of the analysis data so that the conclusion is accurate. Analysis was also carried out on six aspects of the activity mathematics according to Bishop. The six mathematics activities according to Bishop are calculate and measure related to numbers, find locations and design that deals with geometry, play and explains that deals with social interactions.

Results and Discussion

Structure of the Banua Oge Traditional House

The Banua Oge is a traditional stilt house of the Kaili people in Palu City with a floor area of approximately 368 m², measuring 32 m in length and 11.5 m in width. Traditionally, before the adoption of the metric system, these dimensions were determined using the local cubit (depa) as a customary unit of measurement, reflecting the indigenous mathematical practices employed by the Kaili community. The house is constructed primarily from ironwood, a durable local timber selected for its exceptional strength and resistance to environmental conditions, thereby ensuring the structural stability and longevity of the building.

Architecturally, the Banua Oge consists of a well-defined vertical and horizontal structural system as shown in Figure 1. The main building is supported by 28 primary pillars, while the kitchen extension is sustained by an additional eight pillars, demonstrating deliberate numerical organization within its architectural design. The roof is constructed in the form of a triangular prism and is decorated with distinctive traditional ornaments. The front and rear gables are embellished with carved wooden panels known as Panapiri, while the ridge ends are crowned with carved ornaments called Bangko-bangko. These architectural elements illustrate the harmonious integration of structural engineering, artistic craftsmanship, and cultural symbolism that characterizes Kaili traditional architecture.

Compared with previous ethnomathematical investigations of Indonesian traditional houses, such as the Larik traditional house in Jambi and the Selaso Jatuh Kembar traditional house in Riau, the Banua Oge demonstrates distinctive architectural characteristics. Its flexible structural design, systematic numerical organization of supporting pillars, and adaptive construction techniques reflect sophisticated indigenous knowledge developed in response to the geographical and environmental conditions of Central Sulawesi. These findings reinforce the ethnomathematical perspective that mathematics is not a universal body of abstract knowledge detached from culture but rather a culturally situated system of ideas that evolves from the practical, environmental, and spiritual needs of a community.

Figure 1. The Banua Oge Traditional House
Source: Personal Documentation (2025)

Beyond its structural features, the Banua Oge embodies profound philosophical and spiritual values through its architectural ornaments. The Panapiri carvings, positioned on the front and rear roof gables, symbolize protection against harmful influences and spiritual disturbances as shown in Figure 2. Within Kaili culture, these ornaments represent security, prosperity, and divine protection for the household. Their presence also signifies the elevated social status of the occupants, as the Banua Oge historically served as the royal residence (Magau) of the Kaili kingdom. Consequently, the Panapiri reflects the authority, prestige, and dignity associated with the royal family.

Figure 2. Panapiri Carving
Source: Personal Documentation (2025)

Above the Panapiri is the Bangko-bangko, a crown-shaped carving placed at both ends of the roof ridge (Figure 3). This ornament functions as a symbol of royal greatness, identity, and ancestral spirituality. According to local cultural beliefs, the Bangko-bangko serves as a medium through which respect is expressed toward ancestors and the natural world, reflecting the intimate relationship between humans, nature, and spiritual beliefs that underpins Kaili cosmology.

Figure 3. Crown or Bangkok-bangkok Ornament
Source: Personal Documentation (2025)

Mathematical Elements Embedded in the Banua Oge Traditional House

The ethnomathematical analysis revealed that the architectural structure of the Banua Oge incorporates diverse mathematical concepts that naturally emerge from indigenous construction practices. These concepts encompass two-dimensional geometry, numerical reasoning, and geometric patterns, illustrating how mathematical thinking is embedded within local cultural knowledge.

Two-Dimensional Geometric Concepts

Triangle

One of the most prominent geometric forms identified in the Banua Oge is the triangle, which appears in both the roof structure and the staircase illustrated in Figure 4. Within the cosmological beliefs of the Kaili people, the roof symbolizes the human head, while the upward-pointing triangular apex represents the spiritual relationship between humans and God. Beneath the roof lies the attic (Mbuva), a sacred space traditionally used to store heirlooms and ritual objects because of its elevated and holy status.

Similarly, the staircase forms an inclined triangular configuration that symbolizes spiritual transition and humility. Traditionally, individuals entering the royal house ascend the stairs with a slightly bowed posture, reflecting respect, reverence, and submission before entering the residence of the Magau (king). Consequently, the triangular form serves not only as a structural component but also as an embodiment of philosophical and spiritual values.

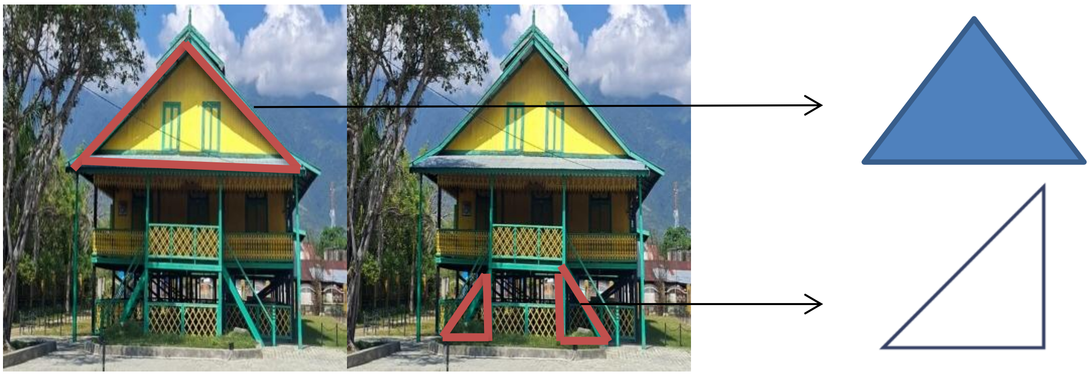

Figure 4. Triangular Forms in the Roof and Staircase of the Banua Oge

Source: Personal Documentation (2025)

Rectangle

Rectangular geometric forms are prominently represented in the doors, walls, and windows of the Banua Oge as shown in Figure 5. Within Kaili culture, these rectangular elements symbolize firmness, balance, justice, and openness in leadership. The large vertical windows, in particular, represent the willingness of leaders to receive and respond transparently to the aspirations of the community.

Figure 5. Rectangular Geometric Elements in the Banua Oge Traditional House

Source: Personal Documentation (2025)

From an architectural perspective, the vertical rectangular design optimizes natural lighting and cross-ventilation appropriate for the tropical climate of Central Sulawesi. Beyond their practical function, community members believe that the uninterrupted circulation of air allows positive energy to enter the house while simultaneously removing negative influences. Accordingly, the rectangular form reflects an integration of functional design, environmental adaptation, and cultural philosophy.

Trapezoid

The trapezoidal form is primarily observed in the architectural design of the veranda (Gandaria) illustrated in Figure 6. This geometric configuration symbolizes transition, openness, and the social boundary separating the royal household from the broader community.

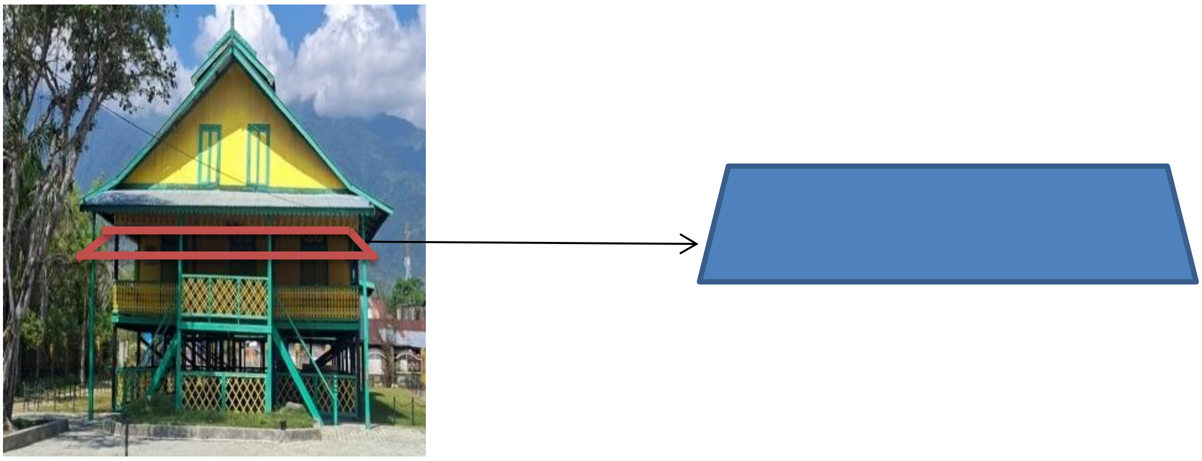

Figure 6. Trapezoidal Form in the Veranda of the Banua Oge

Source: Personal Documentation (2025)

The widening shape of the trapezoid represents a transitional space where visitors begin adapting to palace customs before entering the central hall (Lonta Karavana). Thus, the veranda functions not merely as an architectural extension but also as a symbolic intermediary space reflecting the hierarchical social structure and ceremonial traditions of the Kaili people.

Number Concept

The Banua Oge also embodies indigenous numerical concepts that reflect customary beliefs and cultural values as shown in Figure 7. One notable example is the nine steps leading to the main entrance of the house. The selection of the odd number nine is not arbitrary but represents a culturally significant number associated with protection, harmony, and well-being. According to local beliefs, the nine-step staircase provides safety for the occupants and instils a sense of confidence, peace, and spiritual security when entering or leaving the royal residence. This finding illustrates that numerical reasoning within Kaili culture extends beyond quantitative purposes to encompass symbolic and philosophical meanings.

Figure 7. Numerical Concept Represented by the Nine-Step Staircase

Source: Personal Documentation (2025)

Pattern Concept

Another important mathematical element identified in the Banua Oge is the concept of regular geometric patterns. The front veranda exhibits a repetitive arrangement of rectangular grids organized symmetrically with consistent spacing, equal angles, and proportional dimensions as shown in Figure 8. These regular patterns demonstrate the application of mathematical principles related to symmetry, repetition, proportionality, and spatial organization.

Within Kaili culture, the orderly arrangement of these patterns symbolizes discipline, harmony, balance, and an organized way of life that remains closely connected with nature. Accordingly, the architectural pattern reflects not only mathematical regularity but also the cultural values that govern social relationships and environmental stewardship within the Kaili community.

Figure 8. Regular Geometric Pattern in the Banua Oge Traditional House

Source: Personal Documentation (2025)

Fundamental Mathematical Activities in the Banua Oge Traditional House Based on Bishop's Framework

To further explore the ethnomathematical characteristics embedded in the Banua Oge traditional house, the findings were analyzed using Alan Bishop's framework of six fundamental mathematical activities. Bishop proposed that mathematics emerges as a cultural practice expressed through six universal human activities: counting, measuring, locating, designing, playing, and explaining. These activities provide a theoretical lens for understanding how mathematical knowledge develops from everyday cultural practices rather than existing solely as formal academic knowledge. The analysis revealed that the Banua Oge embodies four of Bishop's six fundamental mathematical activities, such as counting, locating, measuring, and designing, whereas explicit evidence of playing and explaining was not identified within the architectural features examined. The presence of these four activities demonstrates that the mathematical knowledge embedded in the Banua Oge is deeply intertwined with the cultural, environmental, and spiritual values of the Kaili community.

Counting

The activity of counting is reflected throughout the architectural planning and construction of the Banua Oge traditional house. Historical records indicate that the building was constructed in 1892, and its development involved a carefully organized sequence of activities, including site preparation, material collection, customary rituals, and construction. This systematic process illustrates the use of quantitative reasoning and temporal organization in traditional architectural practices.

Counting is further evident in the deliberate numerical organization of the building's structural components. The main structure is supported by 28 primary pillars, while the kitchen extension is sustained by eight supporting pillars, representing a carefully calculated distribution of structural loads while functionally separating public and domestic spaces. Likewise, the house incorporates two staircases, each consisting of nine steps, an intentionally selected odd number that carries symbolic significance within Kaili culture. Beyond its structural function, this numerical arrangement reflects indigenous beliefs that odd numbers provide protection, safety, and spiritual harmony. Consequently, counting in the Banua Oge extends beyond simple enumeration and demonstrates the integration of quantitative reasoning with architectural functionality, cultural symbolism, and social organization.

Locating

The activity of locating is demonstrated through the intentional orientation of the Banua Oge according to the cardinal directions. Rather than representing a purely architectural decision, the selection of the building site reflects sophisticated spatial reasoning grounded in indigenous environmental knowledge. Within Bishop's framework, locating encompasses the mathematical processes involved in identifying positions, organizing spatial relationships, and navigating physical environments.

The Banua Oge is deliberately oriented toward the east, aligning the building with the rising sun. According to Kaili cultural beliefs, this orientation promotes health, vitality, and well-being by maximizing exposure to morning sunlight. Such orientation also reflects practical environmental considerations related to natural lighting, thermal comfort, and ventilation appropriate for the tropical climate of Central Sulawesi. This deliberate alignment demonstrates that the Kaili community integrated spatial geometry, environmental observation, and cultural values into the planning of the built environment. Therefore, the orientation of the Banua Oge illustrates how mathematical reasoning is embedded within indigenous spatial practices that seek to maintain harmony between human life and the natural environment.

Measuring

The activity of measuring is manifested through the use of traditional anthropometric measurement systems in constructing the Banua Oge. Prior to the adoption of standardized metric units, the Kaili people employed the hasta (forearm length) as the principal unit for determining architectural dimensions. This indigenous measurement system provided a consistent and culturally meaningful basis for designing the house while maintaining proportional relationships among its structural components.

Using this traditional unit, the builders established the overall dimensions of approximately 32 m × 11.5 m, with the stilt floor elevated about 5 m above the ground. These measurements reflect deliberate mathematical reasoning that integrates human body proportions, structural stability, and environmental adaptation. The elevated floor protects the building from flooding, enhances natural air circulation beneath the house, and improves thermal comfort in a humid tropical environment. Accordingly, the measuring practices embodied in the Banua Oge illustrate the sophisticated application of anthropometric geometry, proportional reasoning, and ecological adaptation within indigenous architectural knowledge.

Designing

The activity of designing is prominently expressed through the architectural composition of the Banua Oge, demonstrating how the Kaili community transformed geometric reasoning into functional and symbolic architectural forms. Within Bishop's framework, designing involves the visualization, creation, and organization of spatial structures through mathematical reasoning.

The Banua Oge is constructed as a traditional wooden stilt house that integrates architectural characteristics of both the Kaili and Bugis cultures. Its roof adopts a triangular geometric form that efficiently distributes structural loads while responding to the region's climatic conditions. Decorative elements further enrich the architectural design. The front and rear gables are enclosed by carved wooden ornaments known as Panapiri, while the roof ridges are crowned with Bangko-bangko carvings. These ornaments exhibit geometric principles such as symmetry, reflection, repetition, and proportional balance, creating visual harmony between the two ends of the building while simultaneously conveying cultural identity and spiritual meaning.

From an ethnomathematical perspective, the design of the Banua Oge demonstrates that architecture represents a synthesis of mathematical reasoning, engineering principles, artistic creativity, and indigenous philosophy. The geometric organization of structural and decorative elements illustrates how mathematical concepts were intentionally employed to produce a building that is structurally resilient, environmentally adaptive, aesthetically balanced, and culturally meaningful. Finally, the designing activity embodied in the Banua Oge confirms that mathematics functions not merely as an abstract discipline but as an integral component of cultural knowledge that guides the creation of sustainable and symbolically significant architectural forms.

Conclusion

This study demonstrates that the Banua Oge traditional house embodies a rich body of ethnomathematical knowledge reflected in its architectural structure and cultural symbolism. The findings reveal several mathematical elements embedded within the house, including two-dimensional geometric shapes, numerical concepts, and geometric patterns that collectively illustrate how mathematical ideas are naturally integrated into indigenous architectural practices. Furthermore, analysis using Alan Bishop's framework identified four of the six fundamental mathematical activities, such as counting, locating, measuring, and designing. Counting is represented by the deliberate numerical organization of the building, consisting of 28 main pillars and eight supporting pillars in the kitchen area. Locating is reflected in the intentional eastward orientation of the house, which is associated with both environmental adaptation and cultural beliefs concerning health and well-being. Measuring is evident in the application of traditional anthropometric units to determine the dimensions of the building, including its floor area, height, and elevation above the ground. Designing is manifested through the stilt-house construction that integrates Kaili and Bugis architectural traditions while incorporating geometric principles into both structural and decorative elements.

The identification of these mathematical elements demonstrates that the Banua Oge provides an authentic ethnomathematical context through which students can recognize that mathematical knowledge exists within their own cultural heritage. Consequently, the findings support the integration of culturally grounded contexts into mathematics instruction, enabling teachers to complement formal classroom learning with informal mathematical experiences derived from students' surrounding environments. Such culturally responsive learning can strengthen students' conceptual understanding, increase engagement, and foster appreciation for the relationship between mathematics and local culture. Moreover, the findings offer a valuable foundation for developing contextualized teaching materials that align mathematical concepts with indigenous knowledge and everyday experiences.

Future research should extend the present study by investigating the implementation and effectiveness of Banua Oge-based learning materials in classroom practice. Experimental and design-based studies are particularly needed to examine how ethnomathematics grounded in local architectural heritage influences students' mathematical understanding, reasoning, problem-solving, cultural awareness, and learning motivation. Such investigations will not only contribute to the advancement of ethnomathematics research but also provide empirical evidence for integrating indigenous cultural heritage into culturally responsive mathematics education.

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Conflict of Interest

The authors declare that there is no conflict of interest related to Publication of this manuscript. In addition, the author has paid attention to ethical issues such as redundancy, plagiarism, ethical violations, falsification of data, double publication, and double filing.

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