Ethnomathematics Journal
Volume 7, No. 1 (2026) pp. 1-10
Online: http://journal.uny.ac.id/index.php/ethnomath
p-ISSN: 2798-9755 e-ISSN: 2776-3676

Exploration of ethnomathematics in the coastal areas of West Kalimantan

Dodi*, Universitas OSO, Indonesia
Zan Zibar, Universitas OSO, Indonesia
Robin Saputra, Universitas OSO, Indonesia
Hendi Santoso, Universitas OSO, Indonesia
Rizqan Khairan Munandar, Universitas OSO, Indonesia
*e-mail: dodi@oso.ac.id (corresponding author)

Received: Aug 27, 2025 | Accepted: Jan 9, 2026 | Online first: Apr 2, 2026

Abstract: This study explores the ethnomathematical practices of coastal communities in West Kalimantan, Indonesia, revealing how traditional knowledge systems contain rich mathematical concepts embedded in daily life activities. Utilizing qualitative methods, field observations, interviews, and documentation, the research highlights how local practices such as maritime navigation, time estimation, fishing tool construction, trade measurements, and traditional crafts reflect applied mathematics. Although these concepts are not formally expressed in academic terms, they demonstrate a deep understanding of geometry, arithmetic, estimation, and patterns. The study underscores the potential of integrating ethnomathematics into formal education to create a more contextual, inclusive, and culturally relevant mathematics curriculum. These findings support of mathematics education by recognizing and legitimizing indigenous knowledge systems as valuable learning resources. By incorporating local mathematical practices into teaching, educators can bridge the gap between abstract concepts and students' lived experiences, fostering deeper engagement, enhancing critical thinking, and strengthening cultural identity.

Keywords: Ethnomathematics, coastal communities, contextual learning, local knowledge, West Kalimantan

How to cite:
Dodi, D., Zibar, Z., Saputra, R., & Santoso, H. (2026). Exploration of ethnomathematics in the coastal areas of West Kalimantan. *Ethnomathematics Journal*, *7*(1), 1–10. https://doi.org/10.21831/ej.v7i1.89451

INTRODUCTION

Mathematics has long been regarded as a standalone, neutral, and value-free discipline. However, various contemporary studies reveal that mathematical practices are inseparable from the cultural and social contexts in which they develop (Bishop, 1988; Ernest, 1991). This understanding gave rise to a field of study known as ethnomathematics, an approach that explores how local communities interpret, develop, and apply mathematical ideas in their daily lives (D'Ambrosio, 1985; Rosa & Orey, 2011). From this perspective, mathematics is not only found in classrooms, but is also embedded within cultural practices, such as traditional measurements, craft patterns, navigation systems, and local measurement techniques (Gerdes, 1999; Zaslavsky, 1996).

The coastal areas of West Kalimantan are rich in cultural diversity and marine-based economic activities. Communities such as the coastal Malay, Bugis, and Bajo ethnic groups rely heavily on traditional knowledge and skills, particularly in fishing, seafaring, seafood processing, and the construction of livelihood tools. Although these activities are not expressed in formal mathematical language, they contain distinct and contextual mathematical concepts. For instance, determining the best time to go to sea based on the lunar phase, measuring wind directions and ocean currents, or designing the shape of nets and boats all reflect mathematical reasoning and logic that deserve further exploration (Barton, 1996; Rosa & Shirley, 2016).

This study is motivated by the need to uncover and document local knowledge as a means of enriching mathematics education in Indonesia. Furthermore, exploring ethnomathematics in coastal communities contributes to the broader understanding that mathematics is not merely a universal product of Western thought, but also the result of diverse cultural interactions (D'Ambrosio, 2001; Bishop, 1988). Introducing mathematical concepts derived from local community life not only enriches learning resources but also strengthens cultural identity and local wisdom (Rosa & Orey, 2011).

The aim of this article is to explore cultural practices in coastal West Kalimantan that contain mathematical elements and to analyze how these concepts can be identified, contextualized, and integrated within the framework of mathematics education. This study also seeks to illustrate how ethnomathematics can serve as a bridge between local knowledge and the formal school curriculum (Rosa & Shirley, 2016).

METHOD

This study employed a qualitative research design with an ethnographic approach, grounded in the perspective of ethnomathematics. The purpose of this approach was to explore, interpret, and understand mathematical knowledge embedded in the cultural practices of coastal communities, particularly as manifested in daily activities such as navigation, fishing, trade, weaving, and boat construction (Creswell & Poth, 2018; D'Ambrosio, 2001; Spradley, 1979).

The research was conducted in coastal areas of Mempawah Regency and North Kayong Regency, West Kalimantan, Indonesia. These locations were selected purposively due to their strong maritime traditions and the continued use of traditional practices in navigation, fishing, and craftsmanship. Participants included local fishermen, boat builders, fish traders, and coastal women involved in weaving fishing nets and baskets. They were selected using purposive sampling, focusing on individuals recognized by the community as having experiential knowledge and long-term involvement in traditional coastal activities (Patton, 2015).

Data were collected through three main techniques:

1. Field Observations

The researchers conducted non-participant observations of daily coastal activities, including fishing trips, navigation practices, weaving processes, trading activities, and boat construction. These observations aimed to identify mathematical ideas related to measurement, spatial orientation, patterns, and proportional reasoning as they naturally occurred in practice (Angrosino, 2007; Spradley, 1980).

2. In-depth Interviews

Semi-structured, in-depth interviews were conducted with participants to explore their understanding, reasoning, and decision-making processes related to their activities. Interview questions focused on how participants estimate distance and time, determine directions, apply proportions in boat construction, and maintain consistency in trade and weaving. This method allowed the researchers to capture implicit mathematical reasoning that is not formally articulated or written (Kvale & Brinkmann, 2009; Seidman, 2013).

3. Documentation

Documentation included photographs, sketches, field notes, and records of traditional terms, motifs, and proportional rules used by the community. These materials supported the interpretation of observed practices and provided visual and contextual evidence of geometric patterns, measurement systems, and numerical structures (Bowen, 2009).

Data analysis followed a qualitative thematic analysis procedure. Observational notes, interview transcripts, and documentation were coded to identify recurring themes related to mathematical concepts and forms of reasoning, such as estimation, proportional reasoning, inductive and deductive reasoning, pattern recognition, and logical comparison (Braun & Clarke, 2006; Miles, Huberman, & Saldaña, 2014).

The identified themes were then interpreted through the lens of ethnomathematics to reveal how mathematical reasoning is embedded in cultural practices (Rosa & Orey, 2011). Triangulation across observation, interviews, and documentation was applied to enhance the credibility and validity of the findings (Denzin, 1978; Creswell & Poth, 2018).

Ethical considerations were observed throughout the study. Participants were informed about the purpose of the research, and verbal consent was obtained prior to data collection. The study respected local customs, knowledge ownership, and cultural values, ensuring that community knowledge was represented respectfully and accurately (Israel & Hay, 2006).

RESULTS AND DISCUSSION

This study aims to explore the cultural practices of coastal communities in West Kalimantan that contextually contain elements of mathematics. Data were collected through a qualitative approach involving field observations, in-depth interviews, and documentation in the coastal areas of Mempawah and North Kayong Regencies. The observation process focused on daily activities that potentially embody mathematical reasoning, such as traditional navigation practices, measurement systems used in fishing and trading, boat construction techniques, spatial arrangements of coastal settlements, and the use of proportional reasoning in tool-making and resource management.

In-depth interviews were conducted with selected informants, including traditional fishermen, boat builders, traders, community elders, and local cultural practitioners. These interviews explored themes related to counting systems, measurement units, estimation strategies, spatial orientation, and decision-making processes embedded in their livelihoods. The interviews also examined how such mathematical knowledge is learned, transmitted across generations, and applied in practical contexts without formal mathematical notation.

Documentation was carried out through photographic records of cultural artifacts and activities relevant to the study. The collected visual data included images of traditional boats and their construction stages, fishing tools and gear (Figure 1), navigational aids, trading instruments, spatial layouts of coastal houses and docks, as well as written or symbolic marks used informally for counting and measurement. These visual artifacts served as supporting data to strengthen the interpretation of ethnomathematical practices observed in the field.

Based on the triangulation of observations, interviews, and documentation, it was found that the coastal population possesses mathematical knowledge that has developed organically through daily practices. This knowledge is hereditary, unwritten, and deeply rooted in livelihood needs such as maritime navigation, trade, tool-making, and boat construction. This section presents the main findings and discussion, organized into the following subsections.

Figure 1. Traditional fishing gear in North Kayong Regency

One of the main findings of this study is the practice of traditional navigation used by local fishermen. They rely on a combination of wind directions, star movements, ocean currents, and environmental cues to determine sailing directions. This system is locally known as the “monsoon wind”. For example, the east wind is recognized as a marker of the tuna season, while the southwest wind is associated with stormy weather. This knowledge allows fishermen to estimate the best times to go to sea or return to shore.

Rather than using a compass or GPS, fishermen depend on experience and natural signs such as the position of the rising and setting sun. In this practice, there is a spatial understanding and a simple coordinate system concept related to direction, distance, and relative position. This demonstrates an internalization of mathematics in an informal but systematic form. In mathematics education, such practices can be connected to concepts of direction, coordinates, and geometric orientation.

To estimate fishing locations, local fishermen use traditional units such as “a net’s throw”, “a number of paddle strokes”, or “a quarter-day’s journey”. Time estimates are also based on the height of the sun or the lunar phases, with expressions like “sun at mid-height” or “crescent moon descending into the sea”. These concepts reflect non-standard measurement systems developed through collective experience.

This estimation ability is relevant to mathematical concepts such as number, measurement, and logical reasoning. Despite lacking standardized units like kilometers or hours, fishermen exhibit high accuracy in estimating location and time, as evidenced by the consistency of their catches and successful voyages.

Coastal women and some fishermen also engage in making woven fish baskets and fishing nets. The weaving process follows certain patterns such as triangles, squares, rhombuses, and spirals. Each shape serves a specific function, such as facilitating water flow or maintaining structural strength. This weaving technique is passed down through generations and involves consistent counting of rows and knots.

This process illustrates mastery of concepts such as repetition, symmetry, and geometric transformation. In the context of mathematics education, these skills can be directly linked to topics such as number patterns and geometric transformations, including reflection, rotation, and translation are detailed in Table 1. For example, the repetitive arrangement of motifs or structural elements in coastal artifacts can be modeled as a numerical pattern problem:

If a motif is repeated every 20 cm along the length of a boat measuring 4 meters, how many motifs are formed, and what is the general formula representing the pattern?

Similarly, symmetry observed in traditional boat designs or woven coastal artifacts can be translated into a reflection problem:

If the left side of a boat hull forms a curve represented by a function or geometric shape, how can the right side be constructed using reflection across a central axis, and what properties remain invariant under this transformation?

This example allows students to identify lines of symmetry and analyze congruence between corresponding parts.

Geometric transformation is also evident in the rotation and translation of repeated patterns used in tool-making or decorative elements. For instance, a rotational transformation problem can be formulated as follows:

A decorative pattern is rotated by 90° around a fixed point and repeated four times to form a complete design; determine the order of rotational symmetry and describe the resulting figure

Likewise, a translation problem may involve shifting a fishing-net pattern horizontally by a fixed vector to cover a larger area without overlapping. By embedding such contextualized problems into mathematics instruction, ethnomathematical practices not only become objects of cultural study but also serve as meaningful learning resources that bridge students' lived experiences with formal mathematical concepts.

In fact, some artisans mentioned that the number of rattan strands used in one layer of weaving corresponds to an arithmetic sequence. The statement that the number of rattan strands used in one layer of weaving corresponds to an arithmetic sequence can be explained as follows. In the weaving process, artisans add rattan strands in a regular and systematic manner from one layer to the next to maintain uniform density and structural balance. For example, an artisan may begin the first layer with 6 rattan strands and then increase the number by a fixed amount, such as 2 strands, in each subsequent layer. As a result, the number of strands in each layer forms an arithmetic sequence (6, 8, 10, 12, …), where the initial term represents the base layer and the common difference reflects the consistent increase required to expand the woven structure evenly.

This pattern is not determined through formal calculation but emerges from experiential knowledge developed over generations. The fixed increment ensures proportional growth of the woven object, prevents distortion, and maintains symmetry. From a mathematical perspective, this practice embodies the concept of an arithmetic sequence, which can be expressed using the general formula $a_n=a_1+(n-1)d$, where a_n denotes the number of rattan strands in the nth layer, a_1 is the number of strands in the first layer, and d is the constant difference between layers.

By interpreting this traditional weaving practice through a mathematical lens, the artisans' intuitive reasoning can be formally connected to school mathematics topics such as number patterns, sequences, and proportional reasoning, thereby reinforcing the ethnomathematical value of the activity.

Tabel 1. Motif Names and Geometric Shapes

Motif Name	Geometric Shape	Geometric Transformation/ Symmetry Type
Four-Point Cross	Square, Triangle	Reflection symmetry (bilateral)
Rattan Helix	Spiral, Circle	Rotational symmetry
Fish Rhombus	Parallelogram	Translation (repetitive pattern)

In the buying and selling of marine products, coastal communities use traditional units such as buckets, bundles, bushels, or dozens. Each unit has a consistent quantitative value within the community, even though it is not standardized metrically. For example, one "bundle of fish" usually consists of five fish, while one "bucket" can vary depending on the type of fish but remains consistent within the same market.

This system demonstrates an understanding of the concepts of classification, grouping, and unit conversion. Although informal, basic principles of arithmetic and logic still apply in this practice. This knowledge holds great potential to be incorporated into contextual mathematics learning that is closely aligned with students' real-life experiences.

The construction of boats by local artisans, as shown in Figure 2, involves fairly complex mathematical principles, especially regarding ratio and proportion. Boat makers determine the length, width, and height of a boat based on practical formulas, such as "boat length = 3 × base width", or "keel height = one-third of the body length". These proportions are not written down but are collectively known and consistently applied.

Figure 2. Fishermen's boat

This process indicates that artisans have an understanding of ratio, proportion, and scale, essential elements of geometry. In formal education, this concept can serve as a powerful example of how mathematics is applied in the real world.

These findings demonstrate that mathematics exists not only in classrooms or textbooks but is deeply rooted in the cultural practices of coastal communities. Ethnomathematics in this context is not just about "finding mathematics in culture", but also about understanding how culture itself develops and maintains distinctive systems of mathematical thinking.

As stated by D'Ambrosio (1985), ethnomathematics is a form of mathematical expression that arises from cultural needs. In the context of West Kalimantan, mathematics emerges as a tool for navigation, economic strategy, craft artistry, and tool-making technology. This approach supports a more contextualized, relevant, and inclusive mathematics education, especially for students from local communities.

Therefore, the exploration of ethnomathematics is important not only as an academic study but also as a contribution to the decolonization of mathematics education. Incorporating local cultural contexts into learning can increase student engagement, strengthen cultural identity, and bridge the gap between theory and practice in everyday life.

CONCLUSION

This study reveals that the coastal communities of West Kalimantan possess a variety of cultural practices rich in mathematical values, even though these are not formally constructed as in conventional mathematics education. Activities such as sea navigation, determining tidal times, crafting fishing tools, and measurement systems in fish trading all indicate the application of concepts such as geometry, arithmetic, estimation, and numerical patterns that are contextual and passed down through generations. The findings of this exploration affirm that the mathematical knowledge developed within coastal communities is a distinctive form of ethnomathematics, reflecting adaptation to the environment and daily life needs. These insights provide a significant contribution to the effort of mathematics education by positioning local knowledge as a legitimate and meaningful source of learning. By integrating ethnomathematical values into the education curriculum, particularly in coastal regions, the learning process can become more relevant, contextual, and empowering for students. Therefore, it is crucial for educators and policymakers to create space for the recognition and integration of local mathematical practices into formal education.

Declarations

Contributorship	:	D: Conceptualization and Writing – Original Draft; ZZ: Formal Analysis and Investigation; HS: Methodology and Writing – Review & Editing; RS: Supervision; RKM: Validation
Funding	:	No funding information from the authors.
Availability of data and materials	:	All data are available from the authors.
Competing interests	:	The author declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.
Additional information	:	No additional information from the authors.

REFERENCES

Angrosino, M. (2007). Doing ethnographic and observational research. Sage Publications.

Barton, B. (1996). Making sense of ethnomathematics: Ethnomathematics is making sense. *Educational Studies in Mathematics*, *31*(1–2), 201–233. https://doi.org/10.1007/BF00143932

Bishop, A. J. (1988). *Mathematical enculturation: A cultural perspective on mathematics education*. Kluwer Academic Publishers.

Bowen, G. A. (2009). Document analysis as a qualitative research method. *Qualitative Research Journal*, *9*(2), 27–40.

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, *3*(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Creswell, J. W., & Poth, C. N. (2018). *Qualitative inquiry and research design: Choosing among five approaches (4th ed.)*. Sage Publications.

D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, *5*(1), 44–48.

D'Ambrosio, U. (2001). *Ethnomathematics: Link between traditions and modernity*. Sense Publishers.

Denzin, N. K. (1978). *The research act: A theoretical introduction to sociological methods (2nd ed.)*. McGraw-Hill.

Ernest, P. (1991). *The philosophy of mathematics education*. Falmer Press.

Gerdes, P. (1999). *Geometry from Africa: Mathematical and educational explorations*. Mathematical Association of America.

Israel, M., & Hay, I. (2006). *Research ethics for social scientists*. Sage Publications.

Kvale, S., & Brinkmann, S. (2009). *InterViews: Learning the craft of qualitative research interviewing (2nd ed.)*. Sage Publications.

Miles, M. B., Huberman, A. M., & Saldaña, J. (2014). *Qualitative data analysis: A methods sourcebook (3rd ed.)*. Sage Publications.

Patton, M. Q. (2015). *Qualitative research & evaluation methods (4th ed.)*. Sage Publications.

Rosa, M. & Orey, D. C. (2011). Ethnomathematics: the cultural aspects of mathematics. *Revista Latinoamericana de Etnomatemática*, *4*(2). 32-54.

Rosa, M., & Shirley, L. (2016). Ethnomathematics and its diverse approaches for mathematics education. *Revista Latinoamericana de Etnomatemática*, *9*(2), 1–22.

Seidman, I. (2013). *Interviewing as qualitative research (4th ed.)*. Teachers College Press.

Spradley, J. P. (1979). *The ethnographic interview*. Holt, Rinehart and Winston.

Spradley, J. P. (1980). *Participant observation*. Holt, Rinehart and Winston.

Zaslavsky, C. (1996). *The multicultural math classroom: Bringing in the world*. Heinemann.