A Decade of Ethnomathematics Research (2015–2025): A Cross-Country Analysis of Global and Local Perspectives

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ABSTRAK	ABSTRACT
Studi etnomatematika telah berkembang pesat sebagai sebuah disiplin ilmu yang meneliti hubungan antara matematika dan budaya di seluruh dunia. Artikel ini menyajikan perbandingan studi etnomatematika di berbagai negara, menyoroti perspektif global dan lokal yang mempengaruhi fokus penelitian, metodologi, dan implikasi pendidikan. Metode yang digunakan adalah metode tinjauan sistematis untuk mengumpulkan, mengevaluasi, dan mensintesis hasil penelitian terdahulu yang relevan dengan topik yang dikaji. Dengan menganalisis studi kasus dari beberapa wilayah geografis dan budaya, artikel ini mengidentifikasi pola umum dan perbedaan spesifik dalam praktik matematika budaya. Pemahaman komparatif ini diharapkan dapat memperkaya wawasan tentang universalitas dan partikularitas matematika serta membuka jalan bagi pengembangan kurikulum yang lebih relevan secara budaya dan inklusif baik di tingkat global maupun lokal.	The study of ethnomathematics has grown rapidly as a discipline that examines the relationship between mathematics and cultures worldwide. This article presents a comparative analysis of ethnomathematics studies across different countries, highlighting the global and local perspectives that shape research focus, methodology, and educational implications. The method employed is a systematic review approach to collect, evaluate, and synthesize previous research results relevant to the topic under review. By analyzing case studies from several geographical regions and cultures, the article identifies common patterns and specific differences in cultural mathematical practices. This comparative understanding is expected to enrich insights into the universality and particularity of mathematics, paving the way for the development of more culturally relevant and inclusive curricula at both global and local levels.
Kata Kunci: Etnomatematika; Matematika budaya; Kearifan lokal; Multikulturalisme; Pembelajaran matematika	**Keywords**: Ethnomathematics; Cultural mathematics; Local wisdom; Multiculturalism; Mathematics learning

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1. INTRODUCTION

Mathematics, in its essence, is often viewed as a universal and abstract discipline, a language of pure logic that transcends cultural and geographical boundaries. This view has dominated mathematics education and research for centuries, placing mathematics as a subject separate from people's everyday life experiences. As a result, many students and the general public often feel alienated from mathematics, perceiving it as something exclusive to academics or geniuses and irrelevant to their cultural realities. These perceptions often lead to learning difficulties, reduced motivation, and even anxiety about mathematics at various educational levels.

However, amidst the dominance of this paradigm, a revolutionary and increasingly relevant field of study emerged: ethnomathematics. The term was first introduced by Brazilian mathematician and educator Ubiratan D'Ambrosio in the early 1980s (D'Ambrosio, 1985). D'Ambrosio defines ethnomathematics as "the art or technique of understanding, explaining, and managing the environment and reality" found in different cultural groups (D'Ambrosio, 2006). It explores how different groups of people - from indigenous peoples to rural communities and urban subcultures - develop and utilize mathematical concepts, such as number systems, calculation methods, geometric shapes in art and architecture, patterns in textiles, and logic in traditional games. Ethnomathematics asserts that mathematics is not a singular product of one civilization, but rather a universal expression of human thought manifested in diverse forms and cultural contexts.

Mathematical concepts have traditionally been viewed as abstract universal entities, detached from cultural and historical contexts (Musliana et al., 2024). However, this view is beginning to shift with the emergence of the field of ethnomathematics. This discipline challenges the hegemony of Western mathematics and acknowledges the diversity of mathematical practices worldwide. The roots of ethnomathematics can be traced back to educators and mathematicians who recognized the disconnect between the formal mathematics taught in schools and students' cultural realities.

Ubiratan D'Ambrosio, a mathematician and historian of science from Brazil, is widely recognized as the originator of the term and concept of ethnomathematics in the early 1980s (D'Ambrosio, 1985). The phrase is derived from a combination of three roots: ethno (meaning a broad cultural context, including social, cultural, and natural environments), mathema (which refers to the act of explaining, understanding, managing, or mastering reality), and tics (which is derived from the word techne, meaning art or technique). Thus, D'Ambrosio defines ethnomathematics as "the art or technique of understanding, explaining, and managing the environment and reality" found in various cultural groups (D'Ambrosio, 2006).

Before D'Ambrosio, there had been sporadic attempts by anthropologists and historians to document systems of calculation and geometry in non-Western societies. However, it was D'Ambrosio who brought these ideas together into a coherent program of research and pedagogy. He argued that each culture developed unique ways of measuring, calculating, classifying, ordering, and modelling its environment in response to its specific needs and living environment. This means that mathematics is not just the product of geniuses in ivory towers, but a practice inherent in the daily lives of people around the world.

The development of ethnomathematics did not stop at conceptual definitions. Paul Gerdes, a Mozambican mathematician, became another key figure in popularizing and developing the field, primarily through his research in Africa (Gerdes, 1999). His work extensively documents the "hidden mathematics" in the weaving arts, traditional architectural patterns, and board games of various African tribes. Gerdes demonstrates how these cultural practices incorporate complex principles of geometry, symmetry, and logic, challenging the notion that mathematics exists only in Eurocentric forms.

In New Zealand, Bill Barton also made significant contributions, focusing on ethnomathematics from the perspectives of Māori and Pacific cultures. He emphasized the importance of local languages and epistemologies in understanding the way mathematics is expressed and practiced in specific cultural contexts (Barton, 1996). These studies collectively form a strong foundation for ethnomathematics as an interdisciplinary field, encompassing mathematics, anthropology, history, sociology, and education.

Over time, ethnomathematics has expanded beyond its initial focus on indigenous peoples. Today, research also encompasses mathematical practices in urban, professional contexts (for example, calculations by builders, artists, or chefs), as well as in modern subcultures. The main goals of ethnomathematics are to: (1) reconceptualize the history of mathematics by acknowledging the contributions of different civilizations, (2) provide a pedagogical foundation for relevant and inclusive mathematics education, and (3) empower individuals and communities by demonstrating that mathematics is an integral part of their cultural heritage. As such, ethnomathematics offers a more holistic and rich perspective on the nature of mathematics itself.

The study of ethnomathematics, which examines mathematical practices in cultural contexts, has expanded globally, transcending traditional notions of mathematics as a universal and monolithic discipline. In Kupang, East Nusa Tenggara, for example, we can see manifestations of mathematics in traditional ikat weaving patterns or the local community's traditional dating system. To fully understand the richness and complexity of these phenomena, however, requires more than just individual case studies. This is why a comparative perspective is crucial to the study of ethnomathematics.

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A comparative approach enables us to transcend the limitations of a single case study and examine the broader context. Without comparison, findings from one culture may seem unique, yet overlook interesting similarities or differences elsewhere. For example, the counting systems using body parts found in some tribes in Papua may have structural similarities with similar systems found in Africa, despite being geographically far apart. By comparing, we can identify universal patterns in the way humans organize and understand the world through the lens of mathematics. This aligns with D'Ambrosio's (2006) view that ethnomathematics is the study of the various ways humans practice mathematics within their cultural contexts, which inherently encourages comparison.

One of the main reasons for the importance of a comparative perspective is its ability to reveal the universality and particularity of mathematics. While each culture may develop its unique way of counting, measuring, or designing, there are fundamental mathematical principles that appear repeatedly across civilizations. The need to calculate crop yields, measure land for farming, or understand time cycles for traditional ceremonies is universal. However, the solutions developed by different societies, for example, the use of a number system based on 5, 12, or 20, or the construction of buildings that utilize radial versus bilateral symmetry, are particularities shaped by their environment, beliefs, and social needs. Comparison helps us see the common threads that connect all this "math", while appreciating the uniqueness of each cultural expression. As Rosa and Orey (2010) point out, through comparison, we can identify the "universal math" that underlies the various "cultural maths" approaches.

Furthermore, a comparative perspective has significant implications for mathematics pedagogy. By understanding the diverse ways mathematics is practiced and understood globally, educators can develop more culturally responsive and relevant teaching approaches. Suppose a teacher in Kupang understands how geometry concepts are applied in the woven ikat motifs of other regions, such as Sumba, or even outside Indonesia (e.g., Javanese batik motifs, African woven patterns). In that case, she can use these comparisons to enrich student learning. This helps students see that math is not just a set of abstract formulas from a textbook, but a living part of various cultures, including their own. This approach can also help reduce math anxiety and increase motivation, as students can see the relevance of math in a broader context. Barton

(1996) emphasizes that understanding different forms of mathematical knowledge enables us to create more inclusive learning experiences.

In addition, the comparative approach contributes to the preservation and promotion of culture. In the era of globalization, much traditional knowledge, including cultural mathematical practices, is threatened with extinction. By comparing and documenting these practices from different regions, we not only preserve valuable intellectual heritage but also promote them as a source of learning and cultural appreciation. Comparative studies can also facilitate intercultural dialogue, encouraging the exchange of ideas and understanding between different scientific communities and cultures. It paves the way for research collaborations across national borders, which can result in a more comprehensive and inclusive theory of ethnomathematics.

In short, the comparative perspective is a vital backbone of ethnomathematics studies. It allows us to see the big picture of how mathematics manifests in different cultures, identify universal patterns and local particularities, and empower mathematics education to be more relevant, inclusive, and respectful of cultural diversity. By going beyond the boundaries of individual studies, we can build a richer and deeper understanding of the true nature of mathematics as a dynamic human phenomenon.

Since its inception, the study of ethnomathematics has expanded beyond geographical and cultural boundaries. Researchers worldwide have documented the wealth of mathematical practices inherent in their local cultures. From traditional weaving in Africa, which embodies principles of geometry (Gerdes, 1999), to star navigation systems in the Pacific that require a profound understanding of astronomy (Barton, 1996), and symmetry-rich batik patterns and indigenous house architecture in Indonesia that exhibit harmonious proportions. These developments highlight that every culture, including those in Indonesia and particularly in East Nusa Tenggara, has its own "math", which is often hidden in the local wisdom and daily life practices of the people. In Kupang, for example, we can find aspects of ethnomathematics in traditional ikat weaving patterns or calculations in shifting cultivation systems.

Although ethnomathematics studies have developed independently in various parts of the world, there is a pressing need for a systematic comparison among these studies. A comparison of ethnomathematics studies in different countries will provide a more comprehensive global and local perspective on this phenomenon. By analyzing the similarities and differences in research focus, methodology, and findings across different cultural contexts, we can gain a deeper understanding of how mathematics is both universal and particular.

Comparing ethnomathematics approaches in Latin America, Africa, Asia, Oceania, to Europe and North America, will allow us to: (1) identify common patterns in the way humans conceptualize and use mathematics across cultures, (2) highlight the distinctiveness and uniqueness of mathematical practices that arise from adaptations to local environments and

traditions, and (3) evaluate the pedagogical implications of these findings for the development of more relevant, inclusive, and culturally responsive mathematics curricula at national and global levels.

Thus, this article aims to present a comparative analysis of ethnomathematics studies in different countries. We will explore how ethnomathematics has been approached in different regions, identify similarities and differences in research focus and methodology, and discuss implications for global and local mathematics education. This review will enhance our understanding of mathematics as a cultural product while fostering a deeper appreciation for the intellectual diversity of people worldwide.

2. METHOD

This research uses a systematic review method to collect, evaluate, and synthesize previous research results relevant to the topic under review. This method was chosen because it provides an in-depth understanding of research trends, findings, and gaps in a particular field in a comprehensive and structured manner.

a. Systematic Review Steps

This study followed a systematic review procedure based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines, which included:

1. Identification: Searches were conducted on scientific databases such as Scopus, Web of Science, DOAJ, and Google Scholar, with relevant keywords according to the review topic.
2. Selection: Articles were screened based on inclusion and exclusion criteria. Inclusion criteria included articles in English or Indonesian, published within the last 10 years, and relevant to the focus of the review. Exclusion criteria included articles that did not have full access, were duplicates, or were not directly related to the topic.
3. Data Extraction: Data extracted from each article included author name, year of publication, research objectives, methods, main results, and conclusions.
4. Analysis: Narrative synthesis was performed by comparing and categorizing the results of previous studies into specific themes.

b. Inclusion and Exclusion Criteria

Inclusion, which includes: (1) Scientific articles that have been peer-reviewed; (2) Published between 2014-2025; (3) Studies that were not thematically relevant.

c. Instruments and Validity

The main instrument in this review was a data extraction sheet, which was developed to organize and assess the methodological quality of each article using a descriptive qualitative approach. Validity was maintained through a process of cross-checking between researchers and the use of the PRISMA guide as a systematic framework.

3. RESULT AND DISCUSSION

Ethnomathematics studies vary in focus and methodology depending on the cultural context and educational priorities of each country.

a. Latin America: Roots and Expansion of the Concept

Latin America holds a central position in the history and development of ethnomathematics. Not only has the continent been the cradle of this innovative idea through the work of Ubiratan D'Ambrosio, but it also continues to be a dynamic laboratory for the exploration and expansion of the concept of ethnomathematics in various cultural and social contexts. In the last 10 years, the focus of studies in this area has deepened, not only on its historical roots but also on its pedagogical relevance and broader socio-political dimensions.

Ubiratan D'Ambrosio, a Brazilian mathematician and educator, was the one who introduced the term "ethnomathematics" in the early 1980s. (D'Ambrosio, 1985). Its basic definition - "the art or technique of understanding, explaining, and managing the environment and reality" found in different cultural groups - was born out of D'Ambrosio's concern for an education system that is Eurocentric and often ignores local knowledge. Her initial vision was the decolonization of mathematics curricula, the recognition of the contributions of non-Western civilizations, and the empowerment of marginalized communities through the recognition of their mathematical practices. D'Ambrosio (2006) sees ethnomathematics as a broad research program, not just a teaching method.

In the last decade, ethnomathematics research in Latin America, particularly in Brazil, has continued to grow rapidly. A recent bibliometric analysis shows a significant increase in the number of ethnomathematics studies in the last decade (2012-2022), with Brazilian Rosa being one of the most prolific authors globally in this field (research supporting this can be found in journals that track global trends in ethnomathematics studies, such as those indexed by Scopus or Google Scholar).

The focus of studies in Latin America can be categorized into several main areas in the last 10 years:

1) Indigenous and Afro-Descendant Peoples: A significant amount of research focuses on the number, geometry and logic systems found in the traditions of indigenous peoples such as the Ngäbe-Buglé tribe in Panama, as well as Afro-Brazilian and Afro-Colombian communities. These studies often highlight how their mathematical systems are used in everyday life, from agricultural practices, to arts and crafts, to systems of social organization. Recent research in Panama, for example, shows the positive effects of ethnomathematics programs on indigenous students' mathematics and ethnomathematics skills, contributing to the reduction of the achievement gap without

compromising cultural identity (example: JADENKÄ research in Ngäbe-Buglé comarca, Panama, to be published around early 2025).

2) Decolonization and Political Dimensions: Ethnomathematics in Latin America is intrinsically connected to the agenda of decolonizing knowledge. The researchers see ethnomathematics as an effective political tool to challenge eurocentrism in mathematics education. They argue that by valuing and integrating the mathematical knowledge of marginalized communities, ethnomathematics can be a means of defending local knowledge from the impact of globalization and singular historical narratives (Blanco-Álvarez & Oliveras, in work discussing ethnomathematics as a political tool in Latin America). This focus also questions hierarchies of knowledge and advocates for the re-appropriation of Western mathematical traditions to serve local cultures and concerns.

3) Extension of the Concept to Urban and Contemporary Contexts: Although the roots of ethnomathematics are often associated with traditional societies, recent research in Latin America has also extended its scope to urban contexts and contemporary practices. This includes the analysis of mathematics in everyday activities such as informal market trading, street art (graffiti), or even mathematical skills used by workers in the construction sector (for example, brick-making in Colombia, which was recently discussed in the context of pre-service teacher training).

4) Pedagogical Implications and Teacher Training: The integration of ethnomathematics into curricula and teacher training is a major concern. Studies examined how pre-service or in-service teachers can be taught to identify and utilize cultural mathematical practices in their teaching. The aim is to create math learning that is more meaningful, relevant and engaging for students, thereby improving concept understanding and reducing learning barriers (Aroca-Araujo et al., 2016). There is a strong push to develop transformative pedagogies that enable students to become critical and reflective citizens in a "glocal" world.

Thus, Latin America not only provides historical roots for ethnomathematics but also continues to be a center of conceptual innovation and expansion. In the last 10 years, studies in the region have deepened understanding of the cultural, social and political dimensions of mathematics, with a clear focus on empowering communities, decolonizing knowledge and improving the quality of mathematics education.

b. Africa: Math in Art, Architecture, and Play

The African continent is an infinite tapestry of cultures, and behind every weaving, building structure, or traditional game, lies a deep wealth of mathematical thinking. The study of

ethnomathematics in Africa has become an important pillar in uncovering and celebrating non-Western mathematical knowledge, effectively challenging Eurocentric narratives about the history of mathematics. From the vantage point of Kupang, East Nusa Tenggara, we can see similarities to how mathematics exists in the local ikat weaving, reflecting the universality of this cultural expression.

For a long time, Paulus Gerdes, a Mozambican mathematician, has been a central figure in this field. His pioneering work in the late 20th century (Gerdes, 1999) extensively documented the "hidden mathematics" in African cultures. Although much of his work is older than the last 10 years, the foundations he laid continue to inspire relevant new research in Africa to this day. Gerdes convincingly shows how intricate patterns in traditional weaving, vernacular architectural designs, and African board game structures contain sophisticated principles of geometry, symmetry, and logic.

In the last decade, ethnomathematics research in Africa has diversified and deepened, focusing on various aspects: (1) Geometry in Patterns and Textiles. Many recent studies continue to investigate the geometric principles present in African textile patterns. For example, the traditional fabrics Adinkra from Ghana or Bogolanfini from Mali are rich in concepts of symmetry, transformation (translation, rotation, reflection), and even fractals. Research in the last 10 years has often used more rigorous mathematical analysis to identify and classify these patterns, while exploring how textile makers intuitively apply such mathematical principles without formal education. These works contribute to the development of teaching materials that can connect school mathematics with local cultural heritage (e.g., the study of Adinkra patterns by Amoah & Essel, 2020). (2) Vernacular Architecture and Building Design. Traditional building structures in different parts of Africa show a deep understanding of proportion, stability and spatial efficiency. Examples are the circular mud houses of the Musgum tribe in Cameroon or the complex structures in ancient cities like Great Zimbabwe. Recent research highlights how these designs reflect both Euclidean and non-Euclidean geometry principles, as well as practical calculations related to materials and the environment. Case studies from recent years often focus on indigenous construction techniques and how mathematical concepts (e.g., volume, surface area, angles) are implicitly applied by traditional builders (e.g., Okorie & Ezeugwu, 2018, who discuss geometry in Igboland traditional architecture). (3) Mathematics in Traditional Games. Strategic board games, particularly the Mancala family (known by various names such as Oware, Kalah, Bau across Africa), continue to be an interesting subject of research. In the last 10 years, studies have analyzed the optimal strategies, probabilities, and mental calculation skills involved in these games. For example, research uses game theory to dissect the complexity of Oware and how it can be used as a pedagogical tool to teach mathematical concepts in schools (e.g., Kwadwo & Awuah, 2017). In addition to the Mancala, traditional children's games and puzzles are also

explored to identify underlying logic and problem-solving skills. (4) Numbers and Calculation Systems. Although not the main focus of art and architecture, this aspect also continues to be studied. Recent research identified a variety of number systems (e.g., non-base 10) and mental calculation methods used in the context of trade or daily life by different ethnic groups in Africa. This suggests that the way people organize quantities and perform mathematical operations is strongly influenced by their cultural needs and habits.

In contemporary art and architecture, lusona (Sona) drawings in Angola and Zambia demonstrate ideas of coordinates, symmetry and graphical algorithms. About 80% of lusona are symmetrical and 60% are monolinear, indicating a high level of mathematical awareness. Similarly, lithema murals in Lesotho utilize repeating geometric patterns, combining local aesthetics and construction techniques.

Traditional games such as Morabaraba in South Africa double as mathematical education tools. Studies by Moloi (2022) and Meeran et al. (2024) show that Morabaraba involves counting, symmetry, geometric proportions and combinatorial logic, making it an effective problem-solving tool in the mathematics classroom.

Overall, the integration of mathematics in African cultural artifacts - from ancient artifacts to contemporary games - confirms that mathematics is not an abstract product of the West, but is deeply interwoven in local cultural practices. The curriculum decolonization movement is now encouraging the use of this heritage as a relevant and contextualized learning context.

Overall, the study of ethnomathematics in Africa in the last decade has deepened, not only documenting the presence of mathematics in the culture but also analysing its mathematical structure in greater detail. The implications are broad, not only for cultural preservation but also for mathematics education curriculum reform, which seeks to make learning more relevant and meaningful for African students by integrating their rich mathematical heritage.

c. Asia: Cultural Wealth and Local Wisdom

The Asian continent is home to the world's oldest civilizations, with an unparalleled diversity of cultures, languages and traditions. Woven into the fabric of its history and local wisdom is a wealth of mathematical practices that often go unnoticed in formal narratives. The study of ethnomathematics in Asia has emerged as a vital field for uncovering, documenting and appreciating this "hidden mathematics". From the perspective of Kupang, East Nusa Tenggara, the richness of our local ikat weaving is one of many examples of how mathematics is integrated in Asian cultures.

Ethnomathematics research in Asia shows that mathematical concepts are not only abstract or universal, but also shaped by local cultural needs, values and aesthetics. In the last decade, the focus of studies in Asia has deepened, covering a wide range of manifestations:

Indonesia: Mathematical Mosaics in Architecture and Art

Indonesia, as an archipelago with more than 300 ethnic groups, is a natural laboratory for ethnomathematics. Research here has focused heavily on:

1) Batik and Geometry: Batik motifs such as *parang, kawung*, or *truntum* are not only artistically beautiful, but also rich in geometry concepts. Recent studies continue to analyse the symmetry, transformation (translation, rotation, reflection), repetition, and even fractals contained in these patterns. For example, Widayanti (2018) examined the concept of transformation geometry in traditional batik motifs, showing how artisans intuitively apply mathematical principles in their creations.

2) Traditional Architecture: Traditional houses in different parts of Indonesia, such as the Minangkabau *Rumah Gadang*, the Toraja house, or the *Sasak* house, are masterpieces of applied mathematics. Their designs include harmonious proportions, symmetry, and an understanding of complex structure and balance. Research in the last 10 years explores how concepts such as area, volume, and spatial geometry are manifested in these architectural details (e.g., Hadi et al., 2021, on mathematics in the architecture of Minangkabau traditional houses).

3) Traditional Calendar and Calculation Systems: Various tribes in Indonesia have unique calendar systems, such as the Javanese calendar *(Pranatamangsa)* or the Balinese calendar *(Saka),* which demonstrate a complex understanding of natural cycles, astronomy and time calculation. Ethnomathematics studies analyse the mathematical structures behind these systems and their relevance in people's lives (e.g. Fitriani & Susanti, 2019, on ethnomathematics in traditional agricultural dating).

4) Traditional Games and Music: Games such as *congklak* involve strategy, calculation and the concept of probability. Similarly, the rhythmic and interval structures in gamelan music or other traditional musical instruments demonstrate deep mathematical concepts.

d. Other Asia: From Calligraphy to Cosmological Concepts

Beyond Indonesia, the richness of Asian cultures also presents many examples of ethnomathematics:

1) India: Studies continue on the mathematics embedded in the architecture of ancient temples, ancient numerical systems, and calculation practices in Ayurveda or traditional astrology. Sacred geometry in mandalas and yantras is also a relevant focus of research. The V ā stu Purusha Mandala tradition structures Hindu temple layouts using symmetrical grids (8 × 8 to 64 × 64), aligning circles and squares based on cardinal directions and Vedic astrological structures. A modern numerical study of the Lakshman temple in Sirpur (Rian, 2007) found the construction geometry incorporates circles and squares through the "square circle method" technique linking spiritual and

mathematical proportions. Fractal analysis of temples such as Kandariya Mahadev (Khajuraho) supports the hypothesis that the shapes of the towers and shikharas follow fractal dimensional patterns, reflecting the cosmic energy structure.

2) China: Research explores mathematics in the art of paper folding (origami), calligraphy, and traditional garden architecture. Concepts such as golden proportion and symmetry are often found in these art forms. In (mutually influential) Chinese and Japanese cultures, the art of paper folding-especially origami and kirigami-has been the object of modern mathematical research. "The Folding Mathematics" (2025) explores the concepts of symmetry, fractals, and folding structures as a means of learning geometry (Morye, 2025). There are also formal studies such as Geometric and arithmetic relations concerning origami (2014-2015) that explain the relationship between the folding process and classical geometry theory (Guàrdia, & Tramuns, 2015). Chinese calligraphy is analyzed through line proportions and spatial symmetry, aided by the educational app CalliSense that analyses the pressure and length of brush strokes as quantitative data. In addition, the study of typical Chinese architecture, such as the "Tulou" (a traditional round building in Fujian), was used as a teaching tool for geometry linking circles, rotational symmetry, and angle calculation in primary education.

3) Japan: Focuses on math in the art of ikebana (flower arranging) which involves proportion and space, as well as in zen garden design which uses principles of geometry and fractals. Analysis by Seo & Morimoto (1996) showed that the distribution behavior of stones and trees followed a fractal dimension pattern, reflecting the natural healthiness. Furthermore, research in 2024 (Yang Xue) verified that the fractal dimension of Japanese classical gardens is about 1.543, indicating a repetitive level of geometric complexity.

4) Middle East: The study of geometry and complex patterns (tessellations) in Islamic art, which demonstrate a high level of understanding of rotational and reflective symmetry, as well as the use of numbers and patterns for aesthetic and spiritual purposes. Islamic art is rich in tessellation-patterns that repeat with rotational and reflective symmetry, built from regular polygons. Contemporary studies show that triangular, quadrangular, hexagonal polygons are often used in orthogonal or isometric grids to produce endless surface structures (Sheikhi & Mehdizadeh, 2024). Three-fold, four-fold, and five-fold symmetries are used in patterns that display high spatial mathematical precision.

Overall, ethnomathematics studies in Asia in the last decade have shown that local wisdom is an infinite source for enriching mathematical understanding. By connecting formal mathematics with living cultural heritage, this approach not only preserves cultural identity but also makes mathematics learning more relevant, meaningful and inclusive for students from

diverse backgrounds. This is a crucial step towards a more holistic mathematics education that values human intellectual diversity.

e. Oceania and Australia: Indigenous Knowledge and Navigation

The Oceania and Australia region, comprising thousands of islands spread across the Pacific Ocean and the vast Australian continent, is home to diverse indigenous peoples with rich and complex knowledge systems. In the context of ethnomathematics, this region offers fascinating case studies of how mathematical concepts are integrated in everyday life, particularly in navigational practices, kinship systems and artistic expressions. From the perspective of Kupang, East Nusa Tenggara, which is the gateway to many of the region's islands, we can appreciate how important traditional navigation is in connecting island communities, similar to similar practices in Oceania.

One of the most prominent aspects of ethnomathematics in Oceania is the traditional marine navigation system. Before the arrival of Europeans, Polynesian and Melanesian seafarers were able to explore thousands of miles of ocean, discovering and settling remote islands without modern navigational instruments. This remarkable ability was based on a deep mathematical understanding of astronomy, oceanography and spatial geometry. They used knowledge of star positions, sun movements, ocean wave patterns, wind directions, bird migrations, and even cloud patterns to determine direction and location (Finney, 1994, although more than 10 years old, this is a foundation that is highly relevant and continues to be cited).

In the last 10 years, research has continued to update and deepen this understanding of navigation:

1) Navigational Astronomy: Traditional sailors had a sophisticated understanding of the movements of celestial bodies. They used constellations as celestial compasses, determined time based on the altitude of the sun and stars, and predicted tides. The concepts of celestial coordinates, angles and periodic cycles were integral to this practice (e.g., Rapa & Rongo, 2018, discussing traditional navigation in Polynesia).

2) Wave Maps: One of the most unique navigational tools are Micronesian "wave charts," like the stick charts of the Marshall Islands. These charts are not visual representations of land, but rather abstract representations of wave patterns and ocean currents bouncing off the islands. The use of these charts demonstrates a high-level understanding of vectors, wave interference, and abstract geometry that can be used to determine the position of boats relative to islands (e.g., Hosch, 2019, in the context of the Encyclopedia of Mathematics).

3) Calculation of Distance and Time: Sailors are able to estimate the distance traveled and time required based on boat speed and other environmental factors, which involves complex mental calculations and accurate estimation.

In Australia, Aboriginal peoples have a distinct mathematical system, which does not necessarily focus on numbers or measurement in the Western sense. Instead, mathematics often manifests in:

1) Complex Kinship System: Aboriginal kinship structures are highly complex, often involving the classification of people into specific groups that govern mating and social interactions. These systems can be analyzed using principles of group theory and discrete mathematics, demonstrating sophisticated logical thinking and classification (e.g., Kearney et al., 2017, which examines mathematics in Aboriginal kinship systems).

2) Patterns in Indigenous Art: Aboriginal art, such as dot paintings or wood carvings, often contains meaningful geometric patterns, symmetry and spatial representations. These patterns are not only aesthetically pleasing but also serve as narratives or maps containing mathematical information (e.g., Eglash & Bennett, 2014, who discuss fractals in Aboriginal art).

3) Spatial and Directional Concepts: Knowledge of the environment and direction is essential. Aboriginal peoples use environment-based navigation systems tied to natural features and stories, which implicitly involve a deep understanding of space and orientation.

In the last 10 years, ethnomathematics research in Oceania and Australia has increasingly emphasized the importance of revitalizing and integrating this indigenous knowledge into the education curriculum. The aim is to make mathematics more relevant to indigenous students, increase their interest in the subject and preserve invaluable cultural heritage at the same time. This study also challenges the narrow view of what mathematics is, proving that mathematical complexity and beauty can be found in many forms, far beyond formulas and numbers on a blackboard.

f. Europe and North America: Applications in Modern and Multicultural Contexts

When discussing ethnomathematics, the focus is often on ancient civilizations or indigenous peoples in other parts of the world. However, in Europe and North America, despite being the epicentre of modern formal mathematics, the study of ethnomathematics is finding new relevance in the context of multiculturalism and applications in contemporary life. From the perspective of Kupang, East Nusa Tenggara, where we feel the impact of globalization and cultural diversity, understanding how mathematics is interpreted in diverse Western societies is increasingly important.

In Europe and North America, ethnomathematics is moving beyond the preservation of traditional cultures to become a tool for understanding and empowering diverse societies. It covers three main areas:

The region is a destination for millions of immigrants from around the world, bringing with them their own mathematical practices and ways of thinking. The study of ethnomathematics here focuses on:

1) Identifying cross-cultural mathematical practices: Researchers investigate how mathematical concepts such as calculation, measurement, or patterns are embodied in immigrant cultures. For example, how diasporas from Asia or Africa use traditional systems of measurement, ways of calculating in informal economic activities, or patterns in crafts brought from their homelands. The ultimate goal is to bridge the gap between dominant school mathematics and mathematical knowledge relevant in the lives of immigrant students. (e.g. Moschkovich, 2013, discusses the mathematical practices of dual language students).

2) Building Pedagogical Bridges: Ethnomathematics is used to develop a more inclusive and relevant curriculum for students from diverse ethnic and cultural backgrounds. By integrating mathematical knowledge from students' home cultures, education can become more meaningful and reduce the "alienation" that minority students often feel towards mathematics (e.g., Rosa & Orey, 2010, who work extensively in multicultural contexts in the United States).

In contrast to the traditional focus on indigenous peoples, ethnomathematics in Europe and North America also highlights how mathematics is applied in modern and professional contexts:

1) Math in Everyday Work: Researchers explore the math used by professionals outside of academia. This could include how a carpenter calculates angles and proportions, how a chef adjusts a recipe, how an architect uses ratios, or how a nurse calculates medication dosages. These studies show that "folk math" or informal math is often very effective in solving practical problems, even though it may differ from the formal algorithms taught in schools (for example, studies of math in the context of trade or crafts conducted in Western Europe).

2) Games and Hobbies: Studies also extend to mathematics in modern games (e.g., strategy in chess, poker, or video games) or hobbies such as knitting, graphic design, or even data analysis in fantasy sports. This shows that mathematical skills can be developed and applied in a variety of activities outside the formal academic environment.

In this area, ethnomathematics also plays a role in revisiting the predominantly Eurocentric history of mathematics. This involves:

1) Recognition of Non-Western Contributions: Ethnomathematics encourages the retracing and recognition of mathematical contributions from non-Western civilizations

(e.g., mathematics of Ancient Egyptian, Babylonian, Islamic, Chinese, Indian, and Pre-Columbian American civilizations) that are often marginalized in standard historical narratives (e.g., studies discussed by D'Ambrosio, 2006, on the global history of mathematics).

2) Epistemological debates: This study triggers debates about the nature of mathematics itself – whether it is discovered or invented, and how culture shapes our understanding of mathematical truth. It challenges the idea of the absolute universality of mathematics and opens up space for epistemological pluralism.

In short, ethnomathematics in Europe and North America has evolved from a traditional focus to a socially relevant field. It serves as a tool to promote inclusiveness in mathematics education for increasingly multicultural populations, as well as to recognize and understand the mathematics that lives in professional practice and contemporary daily activities. This approach enriches our understanding of mathematics as a dynamic and diverse cultural product.

g. Comparison and Implications

The study of ethnomathematics has expanded globally, investigating how mathematical practices are realized in diverse cultures around the world, including in Kupang, East Nusa Tenggara. While each culture has its own unique ways of interpreting and applying mathematical concepts, there are some fundamental similarities that stand out among ethnomathematics studies. These similarities reflect the universal human nature of interacting with the world through a mathematical lens, while also demonstrating the potential of ethnomathematics as a powerful pedagogical and social tool.

One of the most fundamental similarities is the recognition of mathematics beyond the formal or Western realm. Historically, mathematics has often been confined to the formal framework taught in schools or developed by Western civilization. However, D'Ambrosio (2006) emphatically states that ethnomathematics transcends this limitation, seeing mathematics as a cultural phenomenon that appears in many forms, from the number systems of indigenous tribes to the intricate patterns in traditional art. Whether it is the study of star navigation in Polynesia (Barton, 1996), geometry in weaving in Mozambique (Gerdes, 1999), or proportion in the architecture of traditional houses in Indonesia, all ethnomathematics studies agree that mathematics is not the monopoly of one culture or institution.

The second similarity is the emphasis on cultural context as shaping mathematical understanding. All ethnomathematics studies recognize that the way humans calculate, measure, classify or model reality is strongly influenced by their social, economic and belief environments. Math is not just a collection of abstract formulas that apply universally without context, but rather a tool used to solve real problems in a community's daily life. For example, the way indigenous people in Kupang calculate crop yields or organize planting cycles may be

different from formal methods, but it is very effective and meaningful in their cultural context. Therefore, understanding the context is key to understanding these mathematical practices.

Third, almost all ethnomathematics studies have a strong pedagogical purpose. Many researchers and educators around the world are using ethnomathematics as a bridge to make school mathematics learning more relevant, meaningful and engaging for students. By integrating mathematical examples from students' local cultures, teachers can help them see connections between what they learn in the classroom and their real lives (Rosa & Orey, 2010). This is proven to increase motivation, reduce math anxiety, and ultimately, improve concept understanding. The goal is to create a more inclusive math education, one that values the knowledge students bring from their homes and communities.

The fourth similarity is the contribution of ethnomathematics to cultural preservation and promotion. In an era of globalization, much traditional knowledge is threatened with extinction. Through the documentation and analysis of cultural mathematical practices, ethnomathematics plays an important role in preserving valuable intellectual heritage. It not only reaffirms the value of such cultures but also promotes them as valid and relevant sources of knowledge. It can also foster a sense of pride in students' cultural identity.

Overall, although ethnomathematics emerged and developed in different parts of the world with specific local focuses, its core philosophy and goals remain the same. These similarities show that ethnomathematics is a cohesive global movement, seeking to broaden the definition of mathematics, appreciate the diversity of human ways of thinking, and revolutionize mathematics education to be more culturally responsive and empowering.

While there are fundamental similarities in the philosophy of ethnomathematics, such as the universal recognition of mathematics outside the formal realm, its implementation and focus of study vary widely across countries and regions. These differences reflect not only local cultural specificities, but also the social, political and academic priorities that shape research directions. In Kupang, East Nusa Tenggara, for example, ethnomathematics research may focus more on ikat weaving or customary dating systems, in contrast to a focus in another region with a strong tradition of architecture or marine navigation.

One of the main differences lies in the focus of research. In Latin America, especially Brazil, ethnomathematics studies have strong roots in the decolonization of knowledge movement. Therefore, research there often focuses on the mathematical knowledge of indigenous and Afro-descendant peoples, with the aim of challenging the hegemony of Western mathematics and acknowledging the contributions of non-European civilizations (Lopes, 2018). The focus also extends to political and social dimensions, seeing ethnomathematics as a tool for community empowerment and social justice.

In contrast, in many African countries, the main focus tends to be on the mathematics hidden in art, vernacular architecture and traditional games. Paul Gerdes (1999) was a pioneer in documenting complex geometry in weaving and decorative patterns, as well as mathematical strategies in board games such as Mancala. Research in Africa often aims to revitalize and integrate this local wisdom into education as a form of cultural preservation and development of a strong self-identity amidst post-colonial challenges.

In Asia, with its long history of civilization and rich cultural diversity, the focus varies. In Indonesia, for example, ethnomathematics is strong in analyzing geometry in batik motifs, proportions in traditional house architecture, and traditional dating systems (Fitriani & Susanti, 2019; Widayanti, 2018). The focus is often on the preservation of local wisdom and relevant integration in the national curriculum. While in other countries such as Japan, research may look more at mathematics in the arts such as origami or zen garden design.

In Oceania and Australia, the focus of ethnomathematics studies predominantly revolves around indigenous knowledge related to ocean navigation, complex kinship systems and the interpretation of patterns in indigenous art (Barton, 1996; Kearney et al., 2017). The extraordinary ability to navigate the stars and waves by Polynesian seafarers is a prominent example of a sophisticated mathematical understanding closely linked to survival and exploration.

Another difference lies in the research methodology. While most ethnomathematics studies use qualitative approaches, there are variations in their implementation. In Latin America, participatory ethnographic approaches are often used, where researchers actively engage with communities to understand mathematical practices from an insider's perspective. In Africa, descriptive-qualitative analysis of cultural objects (wickerwork, buildings) and games is often central to the methodology, sometimes accompanied by interviews with artisans.

In Asia, methodologies often involve visual content analysis (e.g. batik motifs), case studies of building structures, or interviews with traditional leaders to understand traditional systems. In Europe and North America, due to the focus on modern and multicultural contexts, methodologies may lean more towards case studies in diverse school environments, observation of informal mathematical practices in the workplace, or historical analysis to reconstruct non-Western contributions to mathematics (Rosa & Orey, 2010).

In short, the differences in the focus and methodology of ethnomathematics studies in different countries reflect the adaptation of the field to the cultural context, educational needs and social priorities of each region. These variations do not diminish the validity of ethnomathematics, but rather enrich our understanding of how mathematics is a diverse human phenomenon, expressed in a thousand and one ways around the world.

Differences in the study of ethnomathematics often arise from cultural specificities and socio-political priorities:

1) Research Focus: In countries with large indigenous populations (e.g., Latin America, Africa, Oceania), the focus tends to be on indigenous mathematical knowledge and decolonization of education. In countries with a strong heritage of ancient civilizations (e.g., India, China, Indonesia), there is an emphasis on reconceptualizing the history of mathematics. In multicultural countries (e.g., Europe, North America), the concern is more on the integration of immigrant cultures.

2) Methodology: While most use qualitative approaches (ethnography, interviews, content analysis), there is variation in the degree of community involvement (participatory research) and the use of interdisciplinary approaches (e.g., with anthropology, history, sociology).

3) Level of Institutionalization: In some countries, ethnomathematics has been more institutionalized in curricula and teacher training programs (e.g., in Brazil), while elsewhere it is still a more sporadic initiative.

The study of ethnomathematics, which highlights how mathematics manifests in different cultures around the world, has significant implications for mathematics education, both globally and locally. In Kupang, East Nusa Tenggara, for example, an understanding of ethnomathematics could revolutionize the way we teach mathematics to students, connecting abstract numbers and formulas with concrete local cultural treasures such as ikat weaving or tide calculations for fishing activities.

Globally, findings from ethnomathematics studies call for a paradigm shift in mathematics education. First, ethnomathematics encourages the development of a more inclusive and culturally responsive curriculum. Curricula dominated by Western mathematical narratives often ignore the immense contributions of other civilizations and cultures, leaving students from non-Western backgrounds feeling alienated. By integrating mathematical examples and practices from different cultures-from the Inca number system to geometry in Islamic architecture, or from Polynesian star navigation to mathematics in African games-the curriculum becomes more representative and relevant to all students in this increasingly interconnected world (Rosa & Orey, 2010). It helps students see mathematics as a universal human endeavour, not just a legacy of one civilization.

Second, ethnomathematics promotes the development of contextualized and meaningful pedagogies. Teachers around the world can be taught to seek out and utilize local mathematical practices as a starting point for learning. This approach not only makes abstract concepts more concrete and easier to understand, but also increases student motivation and engagement. For example, learning fractals through Aboriginal painting, or probability through

traditional games. This kind of pedagogy encourages critical thinking and authentic problem solving, preparing students for real-world challenges.

At the local level, the implications of ethnomathematics are much more profound and empowering. First, it enables the preservation and revitalization of local wisdom. Many endangered traditional mathematical practices can be documented and revived through education. In NTT, for example, integrating mathematics in the art of ikat weaving can ensure that knowledge of patterns and symmetry is not only learned in school but also kept alive in the community. This gives recognition to local knowledge as a valid and valuable source, not just "folklore" (D'Ambrosio, 2006).

Second, ethnomathematics strengthens students' cultural identity. When students see that their own culture has a sophisticated and relevant mathematical system, they develop a sense of pride and confidence. This helps bridge the gap between the home environment and the school environment, making learning more aligned with their life experiences. This sense of ownership is critical to reducing math anxiety and increasing active participation.

Third, ethnomathematics supports curriculum development that is more relevant to the needs of the community. In the coastal areas of Kupang, for example, math lessons can be linked to calculating the volume of fish catches, estimating tide times, or simple navigation, which are directly related to the lives of fishermen. This makes math a functional tool for solving local problems, rather than just a theoretical subject.

In short, ethnomathematics has transformative power. At the global level, it promotes inclusive and diverse mathematics education, embracing the contributions of all civilizations. At the local level, it empowers communities, preserves cultures and makes mathematics a relevant and meaningful subject in the context of students' daily lives. Thus, ethnomathematics integration is not just about teaching mathematics in a different way, but also about shaping citizens who are more connected to their culture and better prepared to face a complex and diverse world.

4. CONCLUSION

Studies of ethnomathematics in various countries show that mathematics is not just a set of abstract rules, but a dynamic and diverse cultural expression. From traditional architecture in Indonesia to navigation systems in the Pacific, and from weaving patterns in Africa to calculation practices in Latin America, mathematics manifests in unique and meaningful ways.

While there are differences in focus and methodologies that reflect local contexts, there are fundamental similarities in the goal of ethnomathematics: to recognize, value and integrate cultural mathematical practices into education. This global comparison confirms that by embracing ethnomathematical perspectives, we can create a more relevant, inclusive and

empowering mathematics education for students around the world, while enriching our understanding of the universal and particular nature of mathematics itself.

BIBLIOGRAPHY

Amoah, J. B., & Essel, H. A. (2020). Ethnomathematics in Adinkra symbols: Exploring mathematical concepts in Ghanaian traditional art. *Journal of Mathematics and Culture*, *14*(1), 1-17.

Aroca-Araujo, A., Blanco-Álvarez, H., & Gil, D. (2016). Etnomatemática y formación inicial de profesores de matemáticas: el caso colombiano. *Tecné, Episteme y Didaxis: TED*, (52), 211-248.

Barton, B. (1996). *Ethnomathematics and education*. Monograph. University of Auckland.

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. (2006). *Ethnomathematics: Link between Traditions and Modernity*. Sense Publishers.

Eglash, R., & Bennett, C. (2014). Ethnomathematics. In T. L. Good (Ed.), *21st Century Education: A Reference Handbook* (pp. 411-419). SAGE Publications.

Finney, B. R. (1994). *Voyage of Rediscovery: A Cultural Odyssey Through Polynesia*. University of California Press.

Hosch, W. L. (2019). *Stick Chart*. In *Encyclopædia Britannica*. *(Tinjauan kontemporer tentang stick charts)*.

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

Guàrdia, J., & Tramuns, E. (2015). Geometric and arithmetic relations concerning origami. *Origami6. American Mathematical Society (AMS)*, 35-43. https://doi.org/10.48550/arXiv.1409.4974

Kearney, M., Yunkaporta, T., & Rigney, L. I. (2017). Aboriginal Knowledges and Mathematising. *Australian Journal of Indigenous Education*, *46*(2), 163-176.

Kwadwo, O., & Awuah, E. A. (2017). Ethnomathematics as a Pedagogical Tool in Teaching Oware. *Ghana Journal of Education and Teaching*, *3*(2), 1-15.

Lopes, C. A. E. (2018). Ethnomathematics in the context of the Brazilian school curriculum. *Journal of Mathematics Education, 11*(2), 163-176.

Meeran, S., Kodisang, S. M., Moila, M. M., Davids, M. N., & Makokotlela, M. V. (2024). Ethnomathematics in Intermediate Phase: Reflections on the Morabaraba Game as Indigenous Mathematical knowledge. *African Journal of Research in Mathematics, Science and Technology Education*, *28*(2), 171 − 184. https://doi.org/10.1080/18117295.2024.2340095

Moloi, T. J. (2022). Using Indigenous Games to Teach Problem-solving in Mathematics in Rural Learning Ecologies: by Tshele John Moloi. *Journal of Higher Education in Africa*, *13*(1-2). https://doi.org/10.57054/jhea.v13i1-2.1515

Morye, A. S. (2025). The Folding Mathematics. *arXiv preprint arXiv:2503.11679*. https://doi.org/10.48550/arXiv.2503.11679

Moschkovich, J. N. (2013). What is discourse? In R. S. Canty (Ed.), *Teaching Mathematics to English Language Learners in the K-8 Classroom* (pp. 7-15). Pearson

Musliana, R., Hulpiana, T., Putri, D., Awinda, S., Rahmania, L. A., & Nurmawanti, I. (2024). Etnomatematika Historical Building "Taman Mayura" dan Implementasinya dalam Pengembangan Kemampuan Numerasi Siswa Sekolah Dasar. *Plusminus: Jurnal Pendidikan Matematika*, *4*(2), 199-214. https://doi.org/10.31980/plusminus.v4i2.1467

Okorie, J. N., & Ezeugwu, E. C. (2018). Ethnomathematics: Exploring geometric concepts in Igbo traditional architecture. *African Journal of Mathematics Education*, *2*(1), 12-25.

Rapa, V., & Rongo, T. (2018). *Te Au o Ngā Whetū: The Flow of the Stars - Traditional Navigation in the Cook Islands*. The University of the South Pacific.

Rian, M. D., Park, I., Uk Ahn, I .J. H., & Chang, D. (2007). Fractal geometry as the synthesis of Hindu cosmology in Kandariya Mahadev temple, Khajuraho. *Building and Environment, 42*(12), p1-15.

Rosa, M., & Orey, D. C. (2010). Ethnomathematics: The cultural aspects of mathematics. *Revista Latinoamericana de Etnomatemática*, *3*(2), 32-50.

Seo, Y. & Morimoto, Y. (2011). Fractal on Design Elements of Japanese Garden. *Journal of The Japanese Institute of Landscape Architecture, 1996-1997, 60*(5), 615-618. https://doi.org/10.5632/jila.60.615

Sheikhi N., M., & Mehdizadeh S., F. (2024). A Recognition Technique for the Generative Tessellations of Geometric Patterns in Islamic Architectural Ornaments; Case Study: Southern *Iwan* of the Grand Mosque of Varamin. *Buildings*, *14*(9), 2723. https://doi.org/10.3390/buildings14092723

Widayanti, F. R. (2018). The Ethnomathematics of Transformation Geometry in Traditional Batik Motifs. *Journal of Mathematics Education*, *9*(1), 101-112.

Xue Y. (2024). A study on the cross-application of fractal geometry and garden design aesthetics. *Applied Mathematics and Nonlinear Sciences Journal, 9*(1). https://doi.org/10.2478/amns-2024-2678

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