

BIMA CULTURAL ETHNOMATHEMATICS AS A FOUNDATION FOR CONTEXTUAL MATHEMATICS LEARNING IN ELEMENTARY SCHOOLS

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Abstract

This study explores the mathematical concepts embedded in the cultural practices of the Bima community and examines their potential integration into elementary school mathematics learning. Using a qualitative exploratory approach, data were collected through field observations, in-depth interviews, and documentation of key cultural artefacts, particularly Uma Lengge (traditional stilt house) and Tembe Nggoli (traditional woven cloth). The findings reveal that both artefacts contain rich mathematical elements relevant to the elementary school curriculum, including geometry, measurement, proportional reasoning, numerical patterns, and symmetry. The architectural structure of Uma Lengge demonstrates applications of two- and three-dimensional shapes, balance, and non-standard measurement, while the motif patterns and weaving processes of Tembe Nggoli reflect concepts of repetition, arithmetic sequences, geometric shapes, and reflective symmetry. These cultural structures naturally embody mathematical reasoning developed through community practices. The integration of these artefacts into contextual learning promotes concrete understanding, strengthens students' spatial reasoning, and enhances cultural literacy. The study also identifies challenges related to limited culturally grounded learning resources, insufficient teacher readiness, and lack of school policy support. Overall, the findings affirm that Bima ethnomathematics provides a meaningful and culturally rooted pedagogical foundation for implementing contextual, humanistic, and locally responsive mathematics education in elementary schools. Future research is encouraged to expand this cultural-based mathematics framework by exploring additional Bima cultural artifacts and testing its effectiveness through classroom-based experimental or quasi-experimental studies.

Keywords: Ethnomathematics; Bima culture; Uma Lengge; Tembe Nggoli; Contextual Learning

Abstrak

Penelitian ini mengeksplorasi konsep matematika yang tertanam dalam praktik budaya masyarakat Bima dan mengkaji potensi integrasinya ke dalam pembelajaran matematika sekolah dasar. Dengan menggunakan pendekatan eksplorasi kualitatif, data dikumpulkan melalui pengamatan lapangan, wawancara mendalam, dan dokumentasi artefak budaya utama, khususnya Uma Lengge (rumah panggung tradisional) dan Tembe Nggoli (kain tenun tradisional). Temuan ini mengungkapkan bahwa kedua artefak tersebut mengandung unsur-unsur matematika yang kaya yang relevan dengan kurikulum sekolah dasar, termasuk geometri, pengukuran, penalaran proporsional, pola numerik, dan simetri. Struktur arsitektur Uma Lengge menunjukkan penerapan bentuk dua dan tiga dimensi, keseimbangan, dan pengukuran non-standar, sedangkan pola motif dan proses tenun Tembe Nggoli mencerminkan konsep pengulangan, urutan aritmatika, bentuk geometris, dan simetri reflektif. Struktur budaya ini secara alami mewujudkan penalaran matematis yang dikembangkan melalui praktik komunitas. Integrasi artefak ini ke dalam pembelajaran kontekstual mempromosikan pemahaman konkret, memperkuat penalaran spasial siswa, dan meningkatkan literasi budaya. Studi ini juga mengidentifikasi tantangan yang terkait dengan sumber belajar yang didasarkan pada budaya yang terbatas, kesiapan guru yang tidak memadai, dan kurangnya dukungan kebijakan sekolah. Secara keseluruhan, temuan tersebut menegaskan bahwa etnomatematika Bima memberikan landasan pedagogis yang bermakna dan berakar budaya untuk menerapkan pendidikan matematika kontekstual, humanistik, dan responsif lokal di sekolah dasar. Penelitian di masa depan didorong untuk memperluas kerangka matematika berbasis budaya ini dengan mengeksplorasi artefak budaya Bima tambahan dan menguji efektivitasnya melalui studi eksperimental atau kuasi-eksperimental berbasis kelas.

Kata Kunci: Etnomatematika; Budaya Bima; Uma Lengge; Tembe Nggoli; Pembelajaran Kontekstual

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Introduction

In the paradigm of 21st-century education, mathematics learning in elementary schools is no longer viewed merely as an effort to master symbols and formulas, but as a means to develop critical, creative, communicative, and contextual thinking skills from an early age. The *Kurikulum Merdeka* emphasizes the importance of learning that integrates cultural values, character development, and students' real-life contexts so that the learning process becomes more meaningful and relevant to their social environment. Within this framework, ethnomathematics emerges as an approach that bridges local culture with formal mathematics, enabling elementary school students to understand abstract concepts through concrete experiences rooted in their daily lives (Jatnika et al., 2025). By integrating elements of local culture, ethnomathematics not only strengthens conceptual understanding but also fosters cultural literacy and nurtures pride in local identity (Della et al., 2024).

However, conditions in the field indicate that this ideal has not yet been fully realized, particularly in the Bima region of West Nusa Tenggara. Mathematics learning in elementary schools is still dominated by conventional, teacher-centered approaches that remain disconnected from cultural contexts. In fact, the Bima community possesses a rich cultural heritage such as the traditional *Tembe Nggoli* weaving, the architecture of the *Uma Lengge* traditional houses, and various traditional socio-economic practices which contain mathematical values that have strong potential to be utilized as learning resources (Az-Zahra et al., 2024; Farhan et al., 2021). Consequently, elementary school students often perceive mathematics as an abstract and difficult subject because they do not find its relevance to their own experiences. This disconnection between the school environment and local culture has implications for students' low learning motivation, limited problem-solving abilities, and weak conceptual understanding in mathematics.

A growing body of research demonstrates that integrating cultural elements into mathematics learning significantly enhances conceptual understanding, fosters positive attitudes toward learning, and increases student engagement. A meta-analysis by Jatnika et al. (2025) involving 20 articles found that 85% of the studies reported improvements in conceptual comprehension and 70% reported increased learning engagement when cultural components were incorporated into mathematics instruction. Ibrahim & Negara (2025) also confirmed that ethnomathematics-based learning can improve conceptual understanding by up to 41%, particularly in concepts related to geometry and numerical patterns. Similarly, studies by Della et al. (2024) highlight that cultural activities such as rituals, traditional games, and handicrafts serve as concrete and enjoyable avenues for elementary students to explore mathematical ideas. However, research that specifically examines Bima culture remains very limited, even though it holds substantial potential for uncovering contextual patterns, geometric forms, and numerical systems (Isnaniah et al., 2023). This gap underscores a significant research opportunity that needs to be addressed to broaden and diversify the application of ethnomathematics in Indonesia.

This study employs a qualitative-exploratory approach to investigate and interpret the mathematical concepts embedded within Bima culture and to examine their potential integration into contextual mathematics learning in elementary schools. Through observations

of cultural practices such as the *Tembe Nggoli* weaving motifs that contain geometric and numerical pattern concepts, and the structure of *Uma Lengge* traditional houses that reflect principles of balance and spatial forms, this research aims to identify mathematical values that can be adapted as instructional media and classroom learning contexts (Az-Zahra et al., 2024; Islamiati & Purnamansyah, 2024). This approach positions culture not only as a learning context but also as a pedagogical foundation that strengthens learning meaning and supports student character development. Accordingly, ethnomathematics can serve as a learning strategy aligned with the spirit of the *Kurikulum Merdeka* and the vision of Society 5.0, which seeks to build harmony between local wisdom, technology, and 21st-century competencies (Nurhusain et al., 2025).

The urgency of this study lies in the effort to present mathematics learning that is meaningful and grounded in local culture from the early grades. Integrating Bima culture into elementary mathematics instruction not only enriches learning contexts but also cultivates character values, curiosity, and pride in regional cultural heritage. Beyond contributing to the development of ethnomathematics theory in the Indonesian context, the findings of this study are expected to serve as a reference for elementary school teachers in designing culturally based contextual learning, as well as for education policymakers seeking to strengthen cultural literacy in primary education (Sutarto, 2018; Wibowo & Ardiansyah, 2023). Previous studies have shown that ethnomathematics positively influences students' understanding, motivation, and engagement in mathematics learning. However, most existing research primarily emphasizes descriptive identification of cultural mathematical elements or focuses on secondary and higher education contexts. Studies that explicitly link local cultural artifacts to the pedagogical needs and competencies of elementary mathematics learning remain limited. In particular, research on Bima culture has generally not examined its direct relevance to elementary school curricula, learners' developmental characteristics, or contextual learning approaches aligned with the *Merdeka Curriculum*. This gap is critical, as elementary mathematics learning requires concrete and meaningful contexts rooted in students' everyday experiences. Therefore, this study is essential in addressing this gap by analyzing Bima ethnomathematics as a foundation for culturally grounded and contextual mathematics learning at the elementary level.

Research Methods

This study adopted a qualitative research approach with an exploratory design to investigate and interpret mathematical concepts embedded in the cultural practices of the Bima community and to examine their relevance to elementary mathematics learning. A qualitative exploratory approach was considered appropriate because ethnomathematics research seeks to understand mathematical ideas as they naturally emerge from cultural activities and social practices within their authentic contexts (Creswell & Creswell, 2018). This design enabled an in-depth exploration of cultural meanings, mathematical structures, and their pedagogical implications without altering the original cultural setting.

The data consisted of primary and secondary sources. Primary data were obtained through field observations, in-depth semi-structured interviews, and documentation of cultural artifacts, particularly *Uma Lengge* traditional houses and *Tembe Nggoli* woven fabrics. Participants were selected purposively based on their cultural knowledge and involvement in relevant practices, including local cultural leaders, traditional house builders, weaving artisans, and elementary school teachers familiar with Bima culture. In addition, a limited number of elementary students from Grades IV to VI were involved to gain preliminary insights into how

students recognize and interpret mathematical concepts embedded in local cultural activities. Secondary data were collected from previous research, curriculum documents, and related to ethnomathematics and contextual learning.

Data collection was conducted in several stages. The initial stage involved field orientation and preliminary exploration to identify Bima cultural practices with potential mathematical relevance to elementary school curricula, such as geometry, measurement, and number patterns. This was followed by systematic data collection through observations and interviews, focusing on the structural features of *Uma Lengge* and the motif patterns and weaving processes of *Tembe Nggoli*. Relevant cultural artifacts were documented using field notes, photographs, and sketches to support analytical accuracy.

Data were analyzed using the interactive model proposed by Miles et al. (2014), which involves data reduction, data display, and conclusion drawing. Collected data were coded and categorized according to fundamental elementary mathematics concepts, including geometric shapes, symmetry, measurement, and numerical patterns. The analysis was guided by D'Ambrosio (1985) ethnomathematics framework and the principles of contextual teaching and learning (CTL) to interpret how cultural mathematical practices can be transformed into meaningful learning contexts for elementary students.

To ensure the credibility and trustworthiness of the findings, data triangulation was employed across sources, techniques, and time. Information obtained from observations, interviews, and documentation was cross-checked to enhance consistency and accuracy. Member checking and prolonged engagement in the research setting were also conducted to minimize researcher bias and strengthen the validity of interpretations.

Result and Discussion

The findings of this study reveal that the cultural heritage of the Bima community contains a rich variety of mathematical concepts that can be utilized as contextual learning resources, particularly in elementary mathematics instruction. Through observations, interviews, and documentation, it was found that two primary cultural artifacts *Uma Lengge* and *Tembe Nggoli* represent the naturally formed mathematical thinking embedded in the daily activities of the Bima people. These artifacts are illustrated in Figures 1 and 2, serving as ethnomathematical media to introduce elementary students to concepts of geometry, number patterns, and measurement in a contextual and meaningful manner.



Figure 1. *Uma Lengge*

Figure 1. *Uma Lengge*, the traditional house of the Bima community, displays a stilted architectural structure with rich and symmetrical geometric forms. The analysis indicates that

Uma Lengge functions not only as a symbol of cultural identity but also as a representation of mathematical principles that can be taught at the elementary level, such as two- and three-dimensional shapes, similarity, symmetry, and concepts of length and height measurement. The roof of *Uma Lengge* forms an isosceles triangular prism supported by a rectangular prism-shaped main structure, making it a concrete medium for introducing both solid and plane geometry. In addition, the proportions of the supporting pillars and room dimensions demonstrate the application of comparison and ratio concepts, traditionally measured using non-standard units such as hand spans or arm lengths (Islamiati & Purnamansyah, 2024). These traditional measurement practices reflect mathematical applications that can be connected to lessons on standard and non-standard measurement in the *Kurikulum Merdeka* for elementary schools. Thus, *Uma Lengge* can serve as a culturally grounded learning medium to strengthen students' understanding of geometry and measurement through observation and exploration of authentic cultural structures in their environment.

In addition to its geometric aspects, *Uma Lengge* also reflects mathematical values through the principles of balance and proportionality. The Bima community traditionally uses human body measurements as references in constructing the house, demonstrating estimation skills and rational, structured thinking. This aligns with D'ambrosio (1985) assertion that every culture possesses distinctive forms of mathematical reasoning shaped by environmental adaptation. These principles of balance can serve as meaningful contexts for elementary mathematics learning, for example through activities in which students build models of traditional houses while considering symmetry, similarity, and proportional relationships among sides and angles. This is consistent with the findings of Yuntawati & Aziz (2025) and Mariamah et al. (2021), who emphasize that the use of cultural artifacts as learning media enhances students' spatial understanding and engagement. By utilizing Figure 1 of *Uma Lengge*, teachers can encourage students to analyze geometric shapes, both solids and planes through activities such as drawing, measuring, or constructing miniature traditional houses as part of culturally based thematic projects.

The next findings focus on Figure 2, which illustrates the motifs of *Tembe Nggoli*, the traditional woven cloth of Bima rich in geometric and numerical patterns. The weaving process of *Tembe Nggoli* demonstrates that the Bima community possesses a deep understanding of patterns, symmetry, and repetition, concepts that form an integral part of elementary mathematics learning. Motifs such as *bali* (lines), *wunta* (flowers), and *kakando* (bamboo shoots) are composed of repeated arrangements of triangles, diamonds, squares, and parallel lines (Az-Zahra et al., 2024). These patterns reveal mathematical regularities that represent number patterns and reflective symmetry, which can be effectively taught to students.



Figure 2. Tembe Nggoli

Furthermore, the weaving process involves repeatedly counting the warp and weft threads, reflecting simple arithmetic sequences and repeated number patterns (Jatnika et al.,

2025). Such activities provide concrete examples for project-based mathematics learning in elementary schools, for instance, through classroom tasks in which students create woven paper patterns to explore concepts of repetition, iterative sequences, and symmetry.

Beyond the descriptive identification of mathematical elements within Bima cultural artifacts, these findings warrant further interpretation in relation to ethnomathematics theory and previous studies. The findings of this study indicate that Uma Lengge and Tembe Nggoli embody mathematical concepts that are not merely symbolic but are functionally integrated into the daily practices of the Bima community. This supports D'Ambrosio's ethnomathematics perspective, which emphasizes that mathematical reasoning emerges naturally from cultural activities and environmental adaptation. Unlike previous studies that primarily document cultural mathematical elements in isolation, this study demonstrates how these elements align directly with elementary mathematics competencies, particularly in geometry, measurement, and number patterns. The architectural structure of Uma Lengge, for instance, provides concrete representations of two- and three-dimensional shapes, symmetry, and proportional reasoning, which are essential concepts in elementary mathematics learning. Similarly, the repetitive motifs and counting processes involved in Tembe Nggoli weaving offer authentic contexts for understanding numerical patterns and symmetry. These findings reinforce prior research suggesting that culturally grounded learning enhances conceptual understanding and student engagement, while extending the literature by positioning Bima cultural artifacts as pedagogical foundations rather than supplementary learning examples.

From a pedagogical perspective, integrating Bima ethnomathematics into elementary mathematics learning enables students to connect abstract mathematical concepts with concrete cultural experiences familiar to their daily lives. This contextualization supports the principles of contextual teaching and learning (CTL), which emphasize meaning-making through real-life situations. The use of Uma Lengge and Tembe Nggoli as learning resources allows teachers to design exploratory and project-based learning activities that foster spatial reasoning, pattern recognition, and proportional thinking. Moreover, this approach contributes to the development of cultural literacy and students' sense of identity, aligning with the objectives of the Merdeka Curriculum and the Profil Pelajar Pancasila. Therefore, ethnomathematics-based instruction not only strengthens cognitive outcomes but also supports holistic student development by integrating cultural, cognitive, and humanistic dimensions of learning.

Previous studies by Yuntawati & Aziz (2025) as well as Della et al. (2024) support this finding, revealing that the use of traditional patterns in classroom instruction not only enhances students' mathematical comprehension but also cultivates cultural awareness and pride. In this context, Tembe Nggoli serves a dual function: it acts as an aesthetic cultural symbol and simultaneously becomes a powerful instructional tool for promoting logical reasoning, creative thinking, and cultural appreciation.

Furthermore, the exploration of weaving techniques and motif structures helps students to naturally recognize regularity, form, and mathematical relationships. This aligns with Zainovi et al. (2025), who emphasizes that cultural practices can serve as meaningful contexts for the exploration of mathematical concepts, particularly when delivered in ways that are concrete, contextual, and relevant to students' lived experiences. Through such integration, mathematics learning becomes more relatable, culturally grounded, and pedagogically impactful for elementary school students.

The findings of this study also reinforce the concept of the *Pembelajaran Nusantara* model proposed by Sutarto (2018), which emphasizes that mathematics learning should be grounded in Indonesia's cultural diversity as an authentic source of knowledge. In this context, *Uma*

Lengge and *Tembe Nggoli* serve as concrete representations of “living mathematics,” illustrating that mathematical ideas are inseparable from the social practices of the community. Integrating these cultural artifacts into elementary mathematics instruction enables students to connect abstract concepts with real-life experiences, thereby strengthening their spatial reasoning skills while simultaneously fostering cultural literacy. Furthermore, supported by digital technologies such as e-modules and interactive animation-based media (Aini, 2025; Zainovi et al., 2025), the implementation of Bima ethnomathematics can be transformed into an innovative learning approach aligned with the spirit of Society 5.0, which aims to harmonize technological advancement with local wisdom.

Nevertheless, the findings also reveal several challenges in implementing ethnomathematics in elementary schools, including the limited availability of culture-based learning resources, the lack of teacher training in interpreting cultural artifacts mathematically, and insufficient school policy support (Fatimah et al., 2024). Therefore, the development of learning media and systematic teacher training is crucial to optimize the use of local cultural potential in classroom instruction. With a well-planned approach, Bima ethnomathematics not only enriches mathematics learning but also serves as a medium for fostering students’ character, identity, and cultural literacy from an early age.

Overall, the findings affirm that *Uma Lengge* and *Tembe Nggoli* possess substantial mathematical value and are highly relevant to fundamental elementary mathematics concepts such as geometry, measurement, and number patterns. By integrating these cultural artifacts into contextual learning, teachers can design more meaningful learning activities, nurture students’ curiosity, and connect mathematical concepts with their lived experiences and cultural background. Thus, Bima ethnomathematics serves as an effective pedagogical foundation for promoting mathematics learning that is inclusive, contextual, and rooted in national identity.

Conclusion

This study demonstrates that Bima cultural artifacts, particularly *Uma Lengge* and *Tembe Nggoli*, embody mathematical concepts that are directly relevant to elementary mathematics learning, including geometry, measurement, symmetry, and numerical patterns. These findings confirm that mathematical knowledge is deeply embedded in local cultural practices and can be meaningfully connected to formal school mathematics when appropriately contextualized.

From a theoretical perspective, this study contributes to the field of ethnomathematics by extending existing research beyond descriptive cultural identification toward pedagogical relevance. Unlike previous studies that position cultural artifacts as supplementary examples, this research highlights their potential as foundational learning resources aligned with elementary mathematics competencies and contextual teaching and learning principles.

Practically, the findings provide valuable insights for elementary teachers and curriculum developers in designing culturally responsive mathematics instruction. Integrating Bima ethnomathematics into classroom practices can support conceptual understanding, enhance student engagement, and foster cultural literacy, in line with the objectives of the Merdeka Curriculum and the Profil Pelajar Pancasila. Future research may further examine the effectiveness of ethnomathematics-based instructional models through classroom implementation and empirical evaluation.

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