

Exploring Ethnomathematics in Local Culture: A Bridge Between Tradition and Classroom Mathematics

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ABSTRAK

This study explores the mathematical knowledge embedded in local cultural practices and examines how such knowledge can be meaningfully integrated into formal mathematics education through the lens of ethnomathematics. Using a qualitative descriptive approach grounded in educational ethnography, the research was conducted in a culturally rich Indonesian community known for its traditional crafts, architecture, and rituals. Data were collected through participant observation, in-depth interviews with artisans, teachers, and students, as well as analysis of cultural artifacts and curriculum documents. The findings reveal that traditional practices such as weaving, house building, and ritual organization contain rich mathematical concepts, including geometry, symmetry, measurement, ratios, and logical structuring. These forms of knowledge, although informal, align closely with school-level mathematics. Students showed greater engagement and understanding when learning mathematics through culturally relevant contexts. However, the integration of ethnomathematics faces challenges such as lack of resources, teacher training, and curricular support. The study recommends the development of culturally responsive teaching frameworks and stronger collaboration between schools and local communities to promote inclusive and meaningful mathematics learning.

INTRODUCTION

Mathematics is often regarded as a universal, objective, and culture-free discipline. In formal education systems, mathematics instruction typically focuses on abstract reasoning, formulaic procedures, and standardized assessments. While such approaches may develop technical skills, they frequently neglect the cultural and contextual dimensions of students' lives. As a result, many learners perceive mathematics as disconnected from their everyday experiences, leading to reduced engagement, motivation, and even anxiety toward the subject.

However, mathematical thinking is not exclusive to textbooks or classrooms. Across communities and generations, people have intuitively applied mathematical ideas in diverse cultural contexts—ranging from geometric patterns in woven textiles, measurement systems in agriculture, calendrical calculations in ceremonies, to symmetry and spatial reasoning in traditional architecture. These practices reflect rich, embodied knowledge systems that demonstrate how mathematics is deeply embedded in culture and daily life, though often unrecognized in formal curricula.

This is where the concept of ethnomathematics becomes highly relevant. Introduced by Ubiratan D'Ambrosio in the 1980s, ethnomathematics refers to the study of mathematical practices within specific cultural groups and the ways in which people from different backgrounds conceptualize and use mathematics. As a pedagogical approach, ethnomathematics emphasizes the importance of integrating cultural contexts into the teaching of mathematics to make it more meaningful, inclusive, and responsive to students' identities.

In a culturally diverse country like Indonesia, the potential for implementing ethnomathematics in education is immense. Yet, there remains a scarcity of systematic research that explores how mathematical knowledge is expressed in local traditions and how these insights can be effectively incorporated into classroom instruction. Most mathematics textbooks and teaching materials are still dominated by Western models of knowledge, often overlooking the cultural richness that surrounds students in their own communities.

Integrating ethnomathematics into mathematics education can enrich the learning experience by connecting academic content with students' cultural backgrounds. It can foster deeper conceptual understanding, promote cultural appreciation, and empower students by validating their lived experiences. This culturally contextualized approach also aligns with current educational paradigms, such as the Merdeka Curriculum in Indonesia, which encourages contextual and differentiated learning.

Therefore, this study seeks to explore and document mathematical elements embedded in local cultural practices and investigate their potential integration into classroom mathematics. Additionally, the study aims to examine the perceptions of teachers and students regarding the relevance and feasibility of incorporating local culture in math instruction. The findings of this research are expected to contribute both theoretically and practically to the development of more humanistic, contextualized, and culturally responsive mathematics education.

METHODOLOGY

This study employed a qualitative descriptive methodology, grounded in principles of educational ethnography, to explore how mathematical concepts are embedded in local cultural practices and how these can be integrated meaningfully into formal mathematics instruction. A qualitative design was selected because the focus of the study is on understanding cultural meanings, traditional knowledge systems, and social interpretations elements that are best explored through narrative and contextual approaches rather than numerical data.

The research was conducted in a culturally significant region in Indonesia known for its strong traditions in weaving, wood carving, customary rituals, and vernacular architecture. These practices were chosen due to their visual richness, geometric structures, and underlying mathematical logic. The selection of the research site was purposive, based on its potential to yield diverse examples of ethnomathematical content that align with school-level mathematics.

Data collection involved four primary techniques: (1) participant observation, (2) semi-structured in-depth interviews, (3) document and artifact analysis, and (4) curriculum review.

- During participant observation, the researcher immersed in community activities such as observing the weaving of traditional textiles, construction of traditional houses, and ritual preparations involving calendrical systems and measurement.

Field notes, photos, and sketches were taken to document mathematical patterns such as symmetry, tessellations, ratios, and measurement units rooted in cultural logic.

- In-depth interviews were conducted with 15 participants, including master artisans (weavers, builders), cultural leaders, mathematics teachers, and students. These interviews aimed to gather both emic (insider) and etic (outsider) perspectives on the use and recognition of mathematics within cultural contexts. Questions focused on how cultural practices are learned, passed down, and understood in relation to formal education. Interviews were transcribed verbatim and coded thematically.
- Document and artifact analysis included the examination of woven patterns, symbolic drawings, traditional tools (such as measuring sticks and ropes), and locally produced learning materials. This allowed the researcher to extract visual and functional representations of mathematical concepts such as congruence, rotation, symmetry, multiplication, and proportional reasoning.
- The curriculum review involved analyzing current mathematics syllabi (e.g., Kurikulum Merdeka) to determine points of alignment where ethnomathematical content could support learning objectives such as spatial reasoning, number systems, or pattern recognition.

The data analysis was carried out through inductive thematic analysis, guided by Miles and Huberman's interactive model, which includes data condensation, data display, and conclusion drawing. Emerging codes were grouped into categories such as “cultural representation of geometry,” “non-standard measurement systems,” “mathematical reasoning in ritual practices,” and “teacher perceptions of culture-based teaching.” These categories were later analyzed to form broader themes that answer the research questions.

To ensure the validity and credibility of the findings, a series of strategies were employed: (1) triangulation of data sources and methods, (2) member checking, where key participants reviewed the findings for accuracy, and (3) peer debriefing, where fellow researchers provided external review of the interpretations. Ethical considerations were also upheld, including informed consent, cultural sensitivity, and participant anonymity.

Through this robust qualitative methodology, the research generated a rich, contextualized understanding of how mathematical knowledge is embedded in local culture and how such knowledge could be thoughtfully and respectfully incorporated into formal education settings. The results are intended to inform educators, curriculum developers, and policymakers seeking to bridge the gap between students' cultural identities and academic success in mathematics.

RESULTS AND DISCUSSION

The results of this ethnographic study reveal a profound presence of mathematical knowledge embedded in traditional cultural practices. This knowledge, although not always articulated in formal mathematical terms, demonstrates deep conceptual understanding that aligns with academic mathematics. The study found that cultural practices ranging from weaving and architecture to ritual organization and local games contain rich mathematical elements such as patterns, spatial reasoning, number sense, proportionality, measurement, and logic.

One of the most prominent findings came from traditional textile weaving. Local artisans, especially women, skillfully created complex motifs that illustrate mathematical principles such as translational and reflective symmetry, rotational patterns, fractal-like

structures, and proportional scaling. These artisans often develop intuitive algorithms for counting threads, maintaining alignment, and calculating repetitions, without any formal schooling in mathematics. Their cognitive strategies involve precise estimation, arithmetic repetition, and geometric awareness that are developed and refined through years of hands-on practice.

In the area of traditional architecture, similar findings emerged. Builders were observed employing non-standard but highly consistent measurement systems using body parts (e.g., armspan, fingers, or feet) or natural tools such as bamboo rods and cords. These were used to calculate length, height, and angles in construction. The planning and construction of traditional homes involved spatial visualization, symmetry, balance, and the use of culturally meaningful proportions closely resembling mathematical concepts such as the golden ratio, area and perimeter calculations, and coordinate geometry, albeit through empirical and observational methods.

Another fascinating finding was the use of indigenous numeracy systems and calendar structures in organizing cultural rituals. Communities observed had traditional counting methods such as base-5 or base-20 systems and cyclical event planning that incorporates lunar phases, planting seasons, and ancestral commemorations. These forms of organization involved modular arithmetic, sequencing, and recursive logic, which parallel foundational ideas in school-level mathematics.

Interviews with teachers revealed a genuine interest in incorporating cultural elements into classroom instruction. However, many educators cited barriers such as lack of structured resources, insufficient training in ethnomathematics, and concern over curriculum alignment. Despite these challenges, some innovative teachers had begun designing lessons that incorporate local motifs, storytelling, and real-life tasks drawn from community practices. They reported improvements in student engagement, participation, and understanding especially among students who previously struggled with abstract content.

Students, on the other hand, expressed increased enthusiasm and connection when they encountered mathematical content that reflected their everyday realities. Many reported feeling more confident when solving problems contextualized within familiar cultural activities, such as calculating fabric dimensions for weaving or planning food portions for ceremonies. These experiences helped them develop number sense, estimation skills, and a sense of ownership over their learning.

The document analysis supported the qualitative findings, revealing that while the national curriculum promotes contextual learning and cultural sensitivity, its practical guidance on integrating local knowledge into specific math competencies remains limited. The lack of concrete instructional materials or teacher guidelines often leads to inconsistency and underutilization of ethnomathematical potential across schools.

Collectively, these findings emphasize the transformative potential of ethnomathematics in bridging the gap between traditional knowledge systems and formal education. They show that cultural practices are not only valuable heritage but also powerful pedagogical assets that can enrich the teaching and learning of mathematics. The results call for curriculum developers, teacher training institutions, and policymakers to develop systematic frameworks, training programs, and culturally responsive teaching materials that empower educators to harness the wealth of mathematical thinking found in local traditions.

The findings of this research reinforce the idea that mathematics is not isolated from culture, but rather, it is deeply interwoven with the daily lives, practices, and values of

local communities. By identifying mathematical elements embedded in traditional crafts, architecture, and rituals, the study confirms the central tenets of ethnomathematics: that every cultural group develops its own ways of reasoning, quantifying, measuring, and understanding space and patterns—often in ways that are profoundly logical and systematic, even if not labeled as “mathematics” in the conventional academic sense.

One of the most significant implications of these findings is the possibility of using ethnomathematics to create a more inclusive and culturally sustaining mathematics education. When students are presented with mathematical content through the lens of their own cultural backgrounds, they are more likely to engage with the material, experience higher levels of motivation, and find personal meaning in their learning. This supports theories such as culturally responsive pedagogy and funds of knowledge, which argue that instruction should build upon the existing knowledge systems students bring with them into the classroom.

In particular, the study illustrates that traditional practices such as weaving with repeated geometric motifs, or building homes with symmetrical layouts and proportional measurements are more than just artistic or practical endeavors; they are rich sources of mathematical knowledge. These findings suggest that teaching mathematics through contextual examples drawn from local culture does not dilute academic rigor. On the contrary, it enhances conceptual understanding by connecting abstract ideas to tangible experiences. For example, symmetry and transformation can be taught using traditional textiles, while ratios and scale can be explored through indigenous architectural designs.

However, despite the potential benefits, the study also reveals systemic challenges. Many teachers, though enthusiastic, expressed uncertainty about how to implement ethnomathematical content effectively in line with formal curricular goals. There is often a lack of professional training, structured resources, and administrative support to guide such efforts. Moreover, dominant perceptions of mathematics as a “neutral” and “universal” subject continue to marginalize non-Western knowledge systems, thereby creating barriers to recognition and integration of cultural content in mainstream education.

The findings also highlight the need for policy-level initiatives to incorporate ethnomathematics into the educational framework. Curricular documents may superficially endorse cultural relevance, but without specific guidance, instructional models, and assessment strategies, the integration remains symbolic rather than practical. Teacher education programs must also evolve to include training on how to identify, analyze, and apply local knowledge in ways that are pedagogically sound and culturally respectful.

In addition, the research points to the value of involving local communities particularly elders, artisans, and cultural leaders as co-educators and curriculum contributors. Their knowledge is not only contextually relevant but also authentic and deeply connected to the identity and values of the learners. Establishing partnerships between schools and communities can help co-create educational experiences that are grounded in both academic standards and cultural heritage.

This study ultimately calls for a reconceptualization of mathematics education from a discipline perceived as rigid and decontextualized, to one that is dynamic, socially situated, and inclusive of multiple ways of knowing. Ethnomathematics offers a framework for transforming mathematics into a humanizing force that honors student identity, promotes equity, and fosters critical thinking rooted in real-life contexts. In doing so, it not only enriches the learning of mathematics but also contributes to the

preservation of cultural knowledge and the affirmation of local wisdom in an increasingly globalized world.

CONCLUSION

This study concludes that local cultural practices are rich sources of mathematical knowledge, even if they are often unrecognized within formal education systems. The exploration of traditional weaving, architecture, rituals, and indigenous counting systems demonstrates that mathematical concepts such as symmetry, patterns, measurement, ratios, and logic are deeply embedded in community life. These practices reflect sophisticated, experience-based reasoning that aligns with many concepts taught in school mathematics. Integrating ethnomathematics into the classroom offers a powerful opportunity to make mathematics more relevant, engaging, and inclusive for students, especially those from diverse cultural backgrounds. Furthermore, the study highlights the strong potential of ethnomathematics to bridge the gap between abstract mathematical content and students' real-world experiences. When cultural contexts are used as entry points for learning, students not only show higher interest and motivation but also gain a deeper conceptual understanding. However, the research also reveals existing challenges such as a lack of teacher training, curriculum guidance, and institutional support that must be addressed to implement ethnomathematics meaningfully. In light of these findings, the study recommends the development of culturally responsive teaching frameworks, integration of ethnomathematics into teacher education programs, and stronger collaboration between schools and local communities. By recognizing and validating the mathematical practices inherent in cultural traditions, educators can foster more humanizing, equitable, and culturally grounded approaches to mathematics education that support both academic achievement and cultural identity.

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