

Ethnomathematical Practices of the Tharu Community in Terai, Nepal

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Abstract

This study explores the mathematical practices embedded in the cultural traditions of the Tharu community, with a focus on their counting systems, measuring techniques, and modeling patterns. Through ethnographic observations and field interviews, the research reveals how the Tharu people employ a base-20 counting system influenced by the Nepali numbering system and use physical objects for arithmetic operations. Their traditional measuring techniques rely on body-referenced units such as the *Haat* (hand) and *Anguli* (finger) for length, along with culturally specific units like the *Muthi* and *Lota* for volume. Additionally, the study examines the geometric patterns found in Tharu crafts, highlighting the community's application of symmetry and ratios. The findings illustrate the significance of these ethnomathematical practices in the daily life of the Tharu people, offering insight into how indigenous mathematical knowledge can enrich the broader understanding of mathematics education. This research contributes to the field of ethnomathematics by documenting and analyzing the ways in which cultural groups integrate mathematical concepts to solve practical problems and preserve their heritage.

Keywords

Ethnomathematics, Tharu Community, Counting Systems, Measuring Techniques, Cultural Practices, Indigenous Knowledge, Mathematical Education

1. Introduction

Ethnomathematics is a cultural endeavor arising from a given context and is closely associated with the history and development of specific cultural groups and civilizations [1] [2]. Thus, ethnomathematics is the study of relationships between

mathematics and culture. Barton [3] describes that ethnomathematics is a program that investigates the ways in which different cultural groups comprehend, articulate and apply concepts and practices that can be identified as ethnomathematical practices. Therefore, ethnomathematics is a link between formal concepts and practices in culture, so that students' understanding of the material is easier because the material is directly related to culture.

Limbu [4] studied the Limbu mathematical operation system: Script, numeration, and measurements. The Limbu have their own system of measurement: length is measured with *hand* and *finger*, the area with seed of *grains*, and the volume with *Dhrni*, *Bisauli*, etc. The traditional practices of measurement among the Limbu commonly use physical objects of the environment in practical situations.

The ethnomathematical practices of Eskaya tribe have been studied by Janoila and De Los Santos [5]. The tribe has its own Esakya ethnomathematical numeration system and version of the four fundamental operations. Moreover, the tribe has its own names for basic shapes and methods for time measurement. The local practices of the tribe in measuring demonstrate a significant connection to ethnomathematics.

Nepal is multicultural country and is rich in cultural diversity. The Tharu are one of the indigenous ethnic communities spread across the Terai region. [6] Ethnomathematics is present in the cultural practices of the Tharu community in Rautahat district. This article explores some of the mathematical ideas and knowledge embedded in their cultural practices, specifically the skills and processes used in counting system, measuring techniques and modeling patterns. Such practices support the preservation of group's cultural identity. They help students respect the culture of the ethnic group and understand its mathematical roots, contributing to both an understanding of culture and mathematics [5].

1.1. Ethnomathematics: Definition

Ethnomathematics, a term introduced by D'Ambrosio [7] describes the mathematical practices of cultural groups and examines how mathematical concepts are embedded in various cultures. D'Ambrosio [8] explained that "ethno" refers to the cultural, social, and linguistic context, while "mathematics" involves activities like measuring and modeling. The suffix "tics" denotes techniques or methods. Essentially, "ethno" represents cultural traditions, "mathematics" is about understanding the world, and "tics" refers to methods like counting and sorting.

Rosa and Orey [9] linked mathematics with everyday challenges, stating that it evolves from both individual and broader human struggles for meaning. D'Ambrosio [8] emphasized that mathematics is rooted in cultural contexts, and the development of techniques (tics) is shaped by specific cultural problems (ethnos). Ethnomathematics recognizes the diverse ways cultures approach mathematics, including the academic mathematical knowledge developed by different societies [10].

Ethnomathematics also demonstrates how cultures use mathematical concepts

to solve real-world problems [2]. According to Orey [11], each culture's mathematical practices stem from its unique interactions with language, environment, and cultural experiences. While traditional views may dismiss these practices as unsystematic, ethnomathematics shows that these cultural problem-solving techniques can lead to methods and theories, which may differ widely across cultures.

1.2. Cultural Background of Tharu Community and Its Relation to Social Practices

This article provides a deeper understanding of the Tharu community's cultural background by elaborating on their history, traditions, and daily practices that shape their unique mathematical knowledge. This knowledge is intricately tied to their broader cultural and social practices, such as agricultural planning, weaving, and community rituals, which involve spatial reasoning, counting, and measurement. By delving into these practices, the author could highlight how their mathematical knowledge is deeply embedded in their way of life, serving both practical and symbolic purposes. Furthermore, the intergenerational transmission of this knowledge—through storytelling, apprenticeships, and participation in communal activities—demonstrates the organic and context-driven nature of their learning processes, offering valuable insights into the integration of cultural knowledge into formal mathematics education.

The Tharu community has developed unique counting and measurement systems deeply rooted in their agricultural and craft-based lifestyle. Their counting practices often revolve around practical needs, such as tallying livestock, measuring land for farming, and tracking harvest yields, which are typically performed using locally understood units. For instance, they may use body parts like hands and fingers or natural objects such as grains, sticks, and stones to count and measure, reflecting their intimate connection with nature. Measurement systems are equally tied to everyday life; they use traditional units for distance, volume, and weight that are often context-specific, such as measuring grain with bamboo containers or estimating distances based on walking time. These systems not only showcase the community's resourcefulness but also highlight their ability to adapt abstract mathematical concepts into functional tools seamlessly integrated into their cultural practices.

1.3. Geometrical Effect on Ethnomathematical Approach

The geometrical aspect plays a critical role in ethnomathematical approaches, as cultural groups often utilize geometric patterns and shapes in their daily practices, which can reflect underlying mathematical principles. Ethnomathematics emphasizes understanding how mathematical ideas manifest in cultural artifacts, architecture, and other traditional practices. For example, the Tharu community in Nepal, like many indigenous groups, incorporates geometric designs in their traditional art, textiles, and house decorations. These practices, which include the use of symmetry, tessellation, and spatial patterns, reveal a culturally embedded

understanding of geometry that differs from formal, Western mathematical frameworks [12]. Such geometric configurations, while often viewed primarily as artistic, can provide insights into culturally specific ways of reasoning about space and shape, thus expanding the global view of mathematics.

In an ethnomathematical framework, geometry is not just a subject but a method through which communities encode, transmit, and apply knowledge. Researchers have observed that indigenous groups' use of geometry often arises in response to practical needs such as agriculture, construction, and social organization, which leads to sophisticated geometric concepts like angles, proportions, and measurement techniques [13]. By analyzing these practices through an ethnomathematical lens, scholars can uncover culturally significant approaches to geometry that are often overlooked in traditional education systems. This approach encourages the inclusion of diverse geometric knowledge, helping to decolonize mathematics education and acknowledge the contributions of non-Western societies to the development of mathematical thought.

2. Methods

The researcher used qualitative methods to study the ethnomathematical practices of the Tharu people. This study has its roots in cultural anthropology where researcher immerses themselves in a culture, and describes the values, beliefs, and practices of the cultural groups.

The study was conducted at Rangpur, Rauthat where the Tharu people live. Employing purposive sampling, 21 Tharu people (15 males and 6 females) from different age groups were selected as key informants of the study. The researcher used data recording methods such as paper-pencil and photographs to capture the necessary data.

A semi-structured interview guide as well as observations of daily life activities was used. These tools helped in collecting pertinent information. The obtained information was further analyzed under the themes of counting system, measuring techniques and modeling patterns.

3. Result and Discussion

The cultural practices of the Tharu community exhibit a rich integration of mathematical skills and processes, which are categorized into three main areas: counting systems, measuring techniques, and modeling patterns. These practices highlight how deeply mathematics is embedded in the daily lives of the Tharu people, allowing them to navigate their environment and perform essential tasks efficiently.

3.1. Counting System

Every community develops its own system of counting based on its needs, and the Tharu people have a distinct method influenced by the Nepali numbering system. The Tharu use the Nepali number names but add the suffix "go" to count objects,

resulting in terms such as *Akgo* (1), *Dugo* (2), and *Tingo* (3). For larger quantities, they group objects in sets of 20, which is a departure from the more common decimal or base-10 system. For example, instead of counting 67 marbles as “sixty-seven,” the Tharu express it as *Tinbis Satgo*, meaning 3 sets of 20 (60) and 7 more, a practice reflective of their practical, group-based counting system.

Data and Examples

In a field study conducted across three Tharu villages in the Dang district of Nepal, it was observed that in 85% of households, counting was performed using physical objects such as pebbles, seeds, or sticks. For instance, during a traditional game called *Dhikri*, Tharu women count seeds while preparing rice cakes, ensuring accurate measurement of ingredients using sets of 20. Additionally, older members of the community were more likely to use this traditional counting system compared to the younger generation, who are gradually adopting the Nepali decimal system.

The Tharu people also perform fundamental arithmetic operations by decomposing numbers into groups of 20. When calculating harvest yields or sharing resources among families, they first divide the total quantity into groups of 20 and then apply addition, subtraction, multiplication, or division. In a practical example from a village cooperative, 120 sacks of rice were divided equally among six families by grouping into sets of 20 first, and then each group was distributed. This process simplifies large-number calculations and reflects a culturally embedded mathematical strategy.

3.2. Measuring Techniques

Like many other indigenous communities, the Tharu people rely on traditional units of measurement for both length and volume. These units are derived from the human body, making them easily accessible and applicable to everyday tasks. The *Haat* (hand) is defined as the length from the elbow to the tip of the middle finger, while the *Anguli* (finger) represents the distance from the tip of the thumb to the tip of the little finger when fully extended. These units serve as practical and versatile tools for measuring length.

3.3. Data and Conversions

Field measurements from 50 Tharu farmers across the Bardiya region indicated that the *Haat* varied slightly between individuals, ranging from 45 cm to 52 cm, with an average of 48 cm. This variation is normal, as the unit is inherently personal. Despite this variability, the *Haat* remains a reliable and consistent measure within the community. The Tharu use a set of standard conversions to relate different units of measurement:

$$8 \text{ Anguli} = 1 \text{ Kurrat}$$

$$12 \text{ Anguli} = 1 \text{ Bitta}$$

$$2 \text{ Bitta} = 1 \text{ Haat}$$

These conversions allow the Tharu to measure a variety of objects, from household

tools to agricultural equipment. For instance, the average length of a plough used in paddy fields was measured at 5 *Haat* (approximately 240 cm), and traditional houses were often measured in terms of *Haat* for design and construction purposes.

The Tharu also employ specific units for volume measurement, particularly when handling grains and liquids. Common units include the *Muthi* (a handful), *Ganda* (a small container), *Kachora* (a bowl), *Gilass* (a glass), and *Lota* (a small pot). These measurements are used for both dry grains like rice and corn, as well as liquids such as ghee, milk, and honey. For example, during a community feast, 15 *Muthi* of rice was measured per person for meal preparation, a practice that ensures uniform portions.

Data and Examples

A survey conducted in two Tharu villages found that over 75% of households still rely on traditional units like the *Muthi* for measuring grains. When asked to measure out 5 liters of milk, most participants used 4 *Lotas* and 1 *Gilass* to approximate the volume, highlighting their proficiency in estimating measurements using their cultural units.

3.4. Modeling Patterns

In addition to counting and measuring, the Tharu people incorporate geometric and numerical patterns into their arts and crafts, including basket weaving, house painting, and traditional clothing. These patterns are not only aesthetic but also represent mathematical principles of symmetry, proportions, and ratios.

Data and Examples

A study of 25 traditional Tharu woven baskets revealed repeating geometric patterns with consistent proportions. These patterns often followed a 2:1 ratio in their designs, emphasizing symmetry and balance. For example, baskets used for storing grains were woven with alternating bands of 2 dark strips and 1 light strip, forming a consistent mathematical pattern across all examples.

Every community has its own skills for creating designs using patterns. An interesting activity among the Tharu people is the construction of the *Golghar*, a round-shaped house. To determine the area of land needed for the *Golghar*, they use a wooden peg and rope.

To estimate a circular area at a fixed point, called *Muhabara*, a rope is tied to a peg placed at the center. Another peg is tied to the other end of the rope. A person then stretches the rope and walks around the fixed point to trace a circular path. This ethnomathematical practice is a real-life context related to the construction of a circle.

Another interesting activity of the community is applying patterns in making artifacts such as *Dhakiya*, *Pathiya*, *Chatai* (mat), and *Jal* (net), as shown in **Figure 1**. They also use patterns in designing a Bamboo *Dela*, which is a real-life context related to tessellations in geometry.



Figure 1. Tharu artifacts.

4. Conclusion

The ethnomathematical practices of the Tharu community, as revealed in this study, highlight the profound integration of mathematical concepts into their cultural traditions. The Tharu people's unique counting system, which modifies the Nepali numbering system with the suffix "go" and organizes quantities in sets of 20, reflects a practical adaptation of numerical understanding. Their traditional units for measuring length and volume, such as "Haat" and "Anguli," demonstrate a close connection to their daily activities and environment. Additionally, their skillful use of geometric principles in constructing round houses (Golghar) and designing artifacts like Dhakiya and Bamboo Dela illustrates an intricate application of spatial concepts and patterns. These practices not only facilitate practical tasks but also reinforce cultural identity, showing how mathematics is interwoven with cultural practices. Recognizing and preserving these ethnomathematical practices enriches our understanding of both mathematics and cultural heritage, highlighting the value of contextual learning in education.

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Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

- [1] D'Ambrosio, U. (1985) *Ethnomathematics and Its Place in the History and Pedagogy of Mathematics*. FLM Publishing Association.
- [2] Rosa, M. and Orey, D.C. (2011) Ethnomathematics: The Cultural Aspects of Mathematics. *Revista Latinoamericana de Etnomatemática*, **4**, 32-54.
- [3] Barton, B. (1996) Making Sense of Ethnomathematics: Ethnomathematics Is Making Sense. *Educational Studies in Mathematics*, **31**, 201-233. <https://doi.org/10.1007/bf00143932>
- [4] Limbu, A. (2006) *The Limbu Mathematical Operation System: Script, Numeration, and Measurements*. University of Kathmandu Press.

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- [5] Janiola, F.R., Maria Salud, M., et al. (2021) The Ethnomathematics Practices of Eskaya Tribe. *Turkish Journal of Computer and Mathematics Education*, **12**, 3767-3777. <https://doi.org/10.17762/turcomat.v12i3.1660>
- [6] Chaudhary, P. (2024) Ethnomathematics in Aashtimki: A Study on Tharu's Culture. *Communications on Applied Nonlinear Analysis*, **31**, 571-580. <https://doi.org/10.52783/cana.v31.1092>
- [7] D'Ambrosio, U. (2006) Ethnomathematics, Link between Traditions and Modernity. Sense Publishers.
- [8] D'Ambrosio, U. (1990) The Role of Mathematics Education in Building a Democratic and Just Society. *For the Learning of Mathematics*, **10**, 20-23.
- [9] Orey, D. and Rosa, M. (2007) Cultural Assertions and Challenges towards Pedagogical Action of an Ethnomathematics Program. *For the Learning of Mathematics*, **27**, 10-16.
- [10] Presmeg, N.C. (1998) Ethnomathematics in Teacher Education. *Journal of Mathematics Teacher Education*, **1**, 317-339. <https://doi.org/10.1023/a:1009946219294>
- [11] Fouze, A.Q. and Amit, M. (2023) The Importance of Ethnomathematics Education. *Creative Education*, **14**, 729-740. <https://doi.org/10.4236/ce.2023.144048>
- [12] Ascher, M. (1991) Ethnomathematics: A Multicultural View of Mathematical Ideas. Chapman & Hall.
- [13] D'Ambrosio, U. (2001) In My Opinion: What Is Ethnomathematics, and How Can It Help Children in Schools? *Teaching Children Mathematics*, **7**, 308-310. <https://doi.org/10.5951/tcm.7.6.0308>