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Silam Sakma, Indigenous Culture, and Ethnomathematics

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Abstract: *Silam Sakma, a symbol of the Limbu community, embodies both cultural heritage and ethnomathematical knowledge. This study explores the connection between the construction of Silam Sakma and the application of fundamental - geometric concepts such as symmetry, rhombuses, squares, and the relationship between parallel and perpendicular lines. Traditionally crafted from bamboo or silk, Silam Sakma reflects a deep concept of geometry with patterns and craftsmanship. By examining this indigenous practice, the study highlights how the Silam Sakma as an ethnomathematical artifact integrates culture into modern education to enhance students' understanding of mathematics while preserving cultural and ethnic identity. The research emphasizes the importance of safeguarding traditional knowledge and fostering a culturally relevant educational practice. Silam Sakma stands as a testament to the Limbu community's resilience, serving both as a protective symbol and as a bridge between cultural traditions and an artifact for mathematical education for future generations.*

Keywords: *Culture, Ethnography, Ethnomathematics, Mythology, Silam Sakma*

Introduction

Nepal's diverse population of 29.16 million encompasses 142 castes and ethnic groups, each with distinct social, economic, cultural backgrounds, languages, and religious beliefs (National Statistics Office [NSO], 2024). The Limbu community, one of Nepal's Indigenous groups, predominantly inhabits the eastern hilly regions of the country. Their rich cultural tapestry is intricately woven into the natural landscape, with a belief system that encompasses animism, nature worship, and ancestor reverence. Central to their spirituality is the worship of *Yuma Mang*, their ancestral mother goddess, and *Tagera Ningwaphuma*, the supreme deity (Limbu, 2016). The sacred oral scripture, Mundhum, serves as a repository of their myths, rituals, and moral codes, reflecting the profound connection the Limbu people have with their environment and ancestors (Limbu, 2015). This oral tradition plays a crucial role in preserving the community's identity and values, especially as some Limbus integrate Hindu and Buddhist elements into their beliefs. Despite these influences, the core traditional practices remain a vital part of their cultural identity.

Silam Sakma, a prominent symbol of the Limbu community, embodies the intersection of cultural identity, mythology, and ethnomathematics. Derived from Limbu words meaning "the way to stop death," Silam Sakma serves as a protective emblem, believed to block the path of death and safeguard family members (Limbu, 2015). Traditionally crafted from bamboo, its design has evolved to include silk, but its symbolic significance endures. The mythology surrounding Silam Sakma recounts a pivotal moment in history when the Kirat people hid from invaders in a cave and wove the emblem as a form of prayer. Their prayers were said to have manifested in cobwebs covering the cave entrance, tricking the attackers into believing it was empty. This narrative underscores Silam Sakma's deep cultural and historical significance, as it represents protection, strength, and the community's resilience.

The term ethnomathematics was coined by Ubiratan D'Ambrosio (1985) to describe the mathematical practices of different groups of people. It is the study of the relations between mathematics and culture. D'Ambrosio (2006) defined the field more precisely as "the mathematics practiced by cultural groups, such as urban and rural communities, groups of workers, professional classes, children in a given age group, indigenous societies, and so many other groups that are identified by the objectives and traditions common to these groups" (p. 1). The very etymology of the term signals its scope: *ethno* encompasses the sociocultural contexts of language, symbols, jargon, and behavioral codes; *mathema* refers to the practices of explaining, understanding, classifying, ordering, measuring, and reasoning; while *tics* derives from the root shared with *art* and *technique* signaling that mathematics, at its deepest level, is a form of skillful human practice (D'Ambrosio, 1985; Rosa & Orey, 2024). Rosa and Orey (2011) extend this understanding by affirming that "mathematics is not culture-free but rather culture-bound" and that ethnomathematical approaches make school mathematics "more relevant and meaningful for students" by connecting it to their lived cultural experiences (p. 33). More recently, Rosa and Orey (2024) have described the dynamic, living quality of this cultural-mathematical relationship through the concept of *ethnomodelling* — arguing that culturally embedded mathematical objects function as ongoing pedagogical tools through which minority cultural groups negotiate and transmit mathematical knowledge as an expression of their cultural identity and survival.

Within this theoretical framework, the ethnomathematical aspects of Silam Sakma are particularly noteworthy in the Limbu community, reflecting the intricate relationship between cultural practices and mathematical concepts. The geometric architecture of Silam Sakma, its diamond form, nine concentric layers, two intersecting axes, and the mathematical precision of its bamboo weaving technique together constitute a vivid instantiation of what Pradhan, Sharma, and Sharma (2021) describe as the *implicit mathematical knowledge* embedded within cultural artifacts: knowledge that, while not formally codified, is rigorously practiced, structurally complex, and culturally indispensable. As Rawat et al. (2024) argue, such indigenous mathematical practices represent not merely a pedagogical resource but a form of epistemic sovereignty, a community's assertion of its own mathematical authorship against the hegemony of purely Eurocentric mathematical traditions. The construction and symbolism of Silam Sakma serve as a profound reflection of the Limbu community's cultural identity and beliefs, revealing the integration of ethnomathematical principles symmetry, concentric geometric patterning, proportional scaling, and the mathematically precise encoding of spatial relationships within their traditional sacred practices. Recognizing and documenting these ethnomathematical dimensions is therefore not only an act of scholarly inquiry but of cultural validation: an affirmation that the Limbu community has always been a community of mathematical thinkers, expressing its mathematical knowledge through the languages and symbols most deeply its own.

Purpose of the Study

This paper intends to explore how the geometric concepts embedded in the crafting of Silam Sakma illustrate the community's mathematical thinking and also highlight the potential for these practices to inform culturally relevant mathematics education. Mathematics educators' perspectives about cultural relevance of basic level of mathematics has been discussed by Acharya et al. (2021) and ethnomathematical research and pedagogical practices by Pradhan et al. (2021). However, there is still a research gap in the area of indigenous culture and ethnomedical connection. The purpose of this paper is to explore the ethnomathematical significance of *Silam Sakma* within the Limbu community, highlighting how mathematical ideas are embedded in their cultural practices, symbols, and oral traditions. By examining the design, construction, and symbolism of *Silam Sakma*, the study aims to reveal the deep connections between indigenous knowledge, spirituality, and mathematical reasoning, thereby contributing to a broader understanding of mathematics as a culturally situated practice.

Method and Procedures

This study outlines the research design and methodology employed, focusing on indigenous epistemologies in ethnomathematics. As qualitative researchers, we aimed to determine the most suitable qualitative research methodology to address the mathematical ideas and practices of the ethnic groups as sociocultural processes (Taylor & Bogdan, 1998). Ethnography emerged as the primary methodology for gathering empirical data about the mathematical concepts, knowledge, and practices embedded in the community's daily activities. By employing ethnographic methods, we aimed to describe, interpret, and uncover the meanings of cultural activities that reflect ethnomathematical ideas. Throughout the research, we continually addressed questions regarding how mathematical concepts are integrated into the community's approach to solving everyday problems and their teaching and learning practices within their cultural contexts (Pradhan, 2020).

Qualitative research, as defined by Creswell (2014), employs a multi-method approach that focuses on interpretative, naturalistic perspectives. This approach allowed us to engage with the community's socio-cultural activities using diverse methods that were sensitive to their beliefs, life experiences, and the specific contexts in which they occur. The study is centered on indigenous epistemologies in ethnomathematics, specifically exploring how geometrical concepts are utilized within local communities and examining the strategies employed by ethnic groups to promote and preserve their indigenous knowledge. The research was conducted in Phikkal Rural Municipality in the Sindhuli district, where we utilized purposive sampling to select five participants. During the analysis and interpretation phases, we aimed to answer key research questions about the basic geometrical concepts practiced by the Wambule Rai community and how these concepts are employed to address daily challenges. To achieve this, we visited the Rai community to observe their use of geometrical concepts firsthand. Data collection methods included observation, interviews, and informal discussions, alongside photographs of various domestic objects. Equipped with tools such as interview guidelines, we navigated the familiar environment of our village, engaging with farmers, elders, and educated individuals. We explained the purpose of our research and conducted interviews with key figures, such as the canal construction leader and senior Kirat Dhami. This hands-on approach allowed us to record their insights while participating in their activities, enhancing the depth of our findings.

Observation played a crucial role in our research, allowing us to gather information about villagers' cultures, daily activities, and geometrical concepts. We conducted both participant and non-participant observations to capture the essence of their practices and document objects that exemplified basic geometrical principles. This method enabled us to uncover insights that interviews alone could not provide, such as the geometrical figures utilized in daily life, their thought processes during the construction of Silam Sakma, and the architectural considerations involved in canal construction.

Through observation, we could also refine our interview guidelines, ensuring they were contextually relevant to the participants' experiences and practices. Ultimately, this ethnographic study focused on indigenous epistemologies in ethnomathematics, aiming to investigate the use of geometrical concepts in local communities, explore strategies for preserving indigenous knowledge, and suggest pedagogical implications for incorporating these insights into formal education. The data collected through observations, photographs, videos, and phone calls were analyzed in conjunction with relevant literature to generate themes that contribute to the understanding of how cultural practices can enrich mathematics education.

Limbu: An Indigenous Community

The Limbu are one of the Indigenous communities of Nepal, predominantly residing in the eastern hills of the country, particularly in districts such as Ilam**,** Panchthar**,** Taplejung**,** and Tehrathum. They belong to the Kirat ethnic group and have a rich history and culture, which is deeply intertwined with the natural landscape of the region (Limbu, 2015). The religion and beliefs of the Limbu community are rooted in Yuma Samyo, the worship of their ancestral mother goddess, Yuma Mang, alongside a reverence for Tagera Ningwaphuma, the supreme deity who governs the cosmos. Their belief system is a blend of animism**,** nature worship, and ancestor worship, where they honor the spirits of nature—such as rivers, mountains, and trees—and seek guidance from their ancestors through rituals led by spiritual leaders known as Phedangma**,** Yeba**,** or Yema**.** The Mundhum is the sacred oral scripture of the Limbu community, serving as a foundation for their religious, cultural, and social practices (Limbu, 2016). It encompasses a rich collection of myths, legends, prayers, moral codes, and instructions for rituals that guide the Limbu people in their spiritual life. The Mundhum is recited by religious leaders like the Phedangma**,** Yeba, and Yema, who use it to conduct important ceremonies, including birth, marriage, death, and other life-cycle events. It also details the relationship between humans, nature, and the divine, reflecting the Limbu's deep connection with their environment and ancestors. Traditionally passed down orally through generations, the Mundhum plays a crucial role in preserving the identity, values, and belief system of the Limbu people. Though some Limbus have integrated Hindu or Buddhist elements over time, their traditional practices remain central to their cultural identity.

Silam Sakma and Mythology

Silam Sakma is a symbol that identifies Limbus. The term 'Silam Sakma' is derived from three Limbu language words. 'Si' signifies death, 'lam' means way, and 'Sakma' denotes to stop or halt. A version of this symbol is placed outside the house to announce that the house belongs to Limbu residents. Limbu belief is that this symbol blocks the path of death and protects family members (Limbu, 2016; Limbu, 2015). It is also worn by the community people on their left chest during an event.

According to the mythology, when Mallas invaded Kiratis in Kathmandu, Mallas started chasing them, and Kiratis hid in a cave. They started praying gods, and some of them started weaving Silam Sakma. Because of their prayer, the entrance of the cave got covered by cobwebs, which the attackers thought meant there was no one inside, and they moved from there. This is how the lives of all hiding Kiratis were saved, hence, since then, Kiratis started worshipping Silam Sakma and believed that it has the highest religious value. The Silam Sakma symbolizes the original armor once used by the Kirat Yakthung Limbu and is now housed in Kerkha Bazaar, Kamal Rural Municipality-3**,** Jhapa. Silam Sakma holds deep cultural and historical significance, with numerous myths and stories surrounding its origin (The Rising Nepal, 2023). One popular belief is that it protected the community from a great calamity, and many

Limbus consider it capable of helping them evade death, making it a crucial protective emblem in their culture. Traditionally crafted from bamboo, Silam Sakma is now woven from silk, but despite the shift in materials, its symbolic importance remains firmly rooted in Limbu traditions. However, as time moves on, traditional materials and practices are gradually disappearing, raising concerns about preserving the Limbu community's cultural heritage (Limbu, 2015). It is necessary to safeguard such artefacts, as they play a vital role in preserving Nepal's cultural heritage in general and the Limbu's culture and their identity in particular. By honoring and promoting Silam Sakma, future generations can remain connected to their roots and continue the rich legacy of the Limbu people.

Silam Sakma and Ethnomathematics

Silam Sakma, a symbol of identity increasingly used in the Limbu community, is also utilized by the Wambule Rai community. In the Wambule language, Silam Sakma is called Dwambwisi. It is said that this tool was used to observe enemies from a far distance and to take precautionary measures. It serves as a weapon used for security. Silam Sakma holds a profound cultural and historical significance, with various myths and stories associated with its origin. The term Silam Sakma is derived from three Limbu language words. Si – signifies death, Lam- means way, and Sakma denotes to stop or halt. Kirat people believe that silam sakma can help them evade death, making it an essential protective emblem within their culture (The Rising Nepal, 2023). Originally, it used to be crafted by cutting bamboo, but now it is woven using silk.

Ethnomathematics in Silam Sakma reflects the intricate relationship between the cultural practices of the Limbu community and their use of mathematical concepts. Traditionally crafted from bamboo and now woven from silk, the construction of Silam Sakma involves geometric patterns, symmetry, and proportionality, all of which are fundamental elements of mathematics. The precise measurements and calculations required to create this emblem, especially in ensuring uniformity in its design, reflect a deep understanding of spatial relationships and structural integrity. The patterns found in Silam Sakma often incorporate circular and linear symmetry, as well as repetitive geometric motifs**,** demonstrating the use of transformational geometry. These designs are not only aesthetic but also serve a cultural purpose, representing protection and harmony within the Limbu worldview. The process of weaving or crafting, particularly from bamboo, would have required knowledge of measurement**,** proportions, and the properties of materials, aligning with practical mathematics.

In this way, Silam Sakma is not only a cultural artefact but also a representation of indigenous mathematical knowledge**,** illustrating how mathematical principles are embedded in the everyday practices of the Limbu people. By studying these patterns and processes, ethnomathematicians can better understand the mathematical thinking inherent in traditional craftsmanship and the cultural significance behind it. The process of construction of the Silam Sakma provides opportunities to work with various geometrical concepts like quadrilateral, rhombus, square, and concepts of parallel

lines and perpendicular lines. It is a rich source of geometrical concepts when viewed from a mathematical perspective (Pradhan, 2020).

In Silam Sakma, patterns and symmetry are evident in the arrangement of cloths, ornaments, and ritual objects, which often display balanced and repetitive designs. Geometric shapes may be seen in decorative items, weaving, or the spatial arrangement of offerings, reflecting translation, rotation, and reflection symmetries. The rhythmic repetition of chants and ritual steps further mirrors the concept of periodic patterns in mathematics, blending aesthetic harmony with structured order. For example, in Silam Sakma, if a ritual cloth has a repeated diamond shape every 10 cm along its length, this shows translation symmetry with a period of 10 cm. If two identical floral patterns are placed opposite each other on either side of the central cloth, they exhibit reflection symmetry across the center line. If a circular arrangement of offerings repeats the same pattern every 90°, it demonstrates rotation symmetry of order 4. The steady beat of a chant, repeating every 8 counts, is a periodic pattern similar to repeating sequences in mathematics, such as 1, 2, 3, 4, 1, 2, 3, 4.

Silam-Sakma can also be used as the logo that identifies the Limbu/Yakthung tribal community. A version of this symbol is placed outside the house to announce that the house belongs to Limbu residents. Limbus belief is that this symbol helps to protect family members. Silam Sakma is not only a cultural artefact but also a significant emblem worn by the Limbu community on the left side of the chest during important events and ceremonies. Wearing it close to the heart symbolizes protection, strength, and a deep connection to their ancestral heritage. Traditionally believed to offer safety and even avert death, Silam Sakma holds a protective role in both a spiritual and cultural sense. Its placement on the left chest, near the heart, signifies its importance as a guardian emblem, reminding the Limbu people of their identity, history, and the myths that surround this sacred symbol.

The construction process of Silam Sakma incorporates geometric principles such as symmetry, proportionality, and spatial reasoning. The process involves working with shapes like quadrilaterals**,** rhombuses**,** and squares, each requiring an understanding of properties such as parallel and perpendicular lines, angles, and symmetry. The careful arrangement of these shapes in patterns introduces learners to spatial reasoning, proportion, and geometric relationships. As artisans create this artifact, they engage with various geometric shapes—quadrilaterals, rhombuses, and squares—applying knowledge of properties such as parallel and perpendicular lines, angles, and symmetry. The precise measurements and careful arrangements of shapes demonstrate a deep understanding of structural integrity and spatial relationships, illustrating the mathematical thinking embedded in traditional craftsmanship. The construction of Silam Sakma offers an excellent opportunity to engage with various geometrical concepts, making it a valuable cultural tool for teaching mathematics. The geometrical concepts learned through the crafting process can help bridge the gap between traditional knowledge and formal mathematical education. This approach not only strengthens students' mathematical understanding but also fosters a deeper connection to their cultural heritage. Silam Sakma thus stands as a testament to the Limbu community's rich traditions and mathematics can be interwoven with cultural identity, ensuring the preservation and continuation of both mathematical knowledge and cultural heritage for future generations.

By integrating these concepts into the crafting of Silam Sakma, educators can create a culture-friendly, mediated tool that allows students to conceptualize mathematics through the lens of their own cultural heritage. This approach not only strengthens their mathematical understanding but also deepens

their connection to Limbu traditions, making learning more meaningful and contextually relevant. The knowledge they practiced in the process of constructing a net of bamboo or silk is equivalent to the geometrical shapes in axioms of Euclidean geometry. The following are the geometrical concepts embedded in their activities.

- The diagonals of Rhombus bisect each other at a right angle.
- Opposite sides of a Rhombus are equal and parallel.
- Each angle of a square and a rectangle are right angle.

The Limbu community's traditional practices in constructing bamboo and silk nets serve as a rich embodiment of fundamental geometrical concepts found in Euclidean geometry. By recognizing and analyzing these embedded principles, we gain insights into the intricate relationship between cultural practices and mathematical knowledge. This understanding not only emphasizes the value of indigenous epistemologies in mathematics but also underscores the potential for integrating such knowledge into contemporary educational frameworks. Ultimately, celebrating and preserving these traditional practices can enhance students' mathematical comprehension while fostering a deeper appreciation for their cultural heritage.

Conclusion

Silam Sakma serves as a powerful symbol of identity, cultural heritage, and protection for the Limbu community. Its rich history, mythology, and evolving craftsmanship make it an emblem that embodies both spiritual and cultural values. The construction of Silam Sakma, with its intricate geometric patterns and symmetrical designs, reflects a deep understanding of ethnomathematics**,** showcasing how indigenous mathematical knowledge is woven into traditional practices. As a cultural tool, it offers opportunities to teach key mathematical concepts such as symmetry, parallel and perpendicular lines, and the properties of shapes like rhombuses and squares. Preserving and promoting Silam Sakma is not only essential for maintaining the cultural legacy of the Limbu community but also for fostering a culturally meaningful approach to education, where traditional knowledge and mathematical learning are seamlessly integrated. The process of constructing Silam Sakma illustrates practical applications of Euclidean geometry in everyday life, offering educators a unique way to connect abstract mathematical concepts with cultural heritage**.**

The geometric ideas of quadrilaterals, rhombuses, and squares**,** which help students gain a concrete understanding of concepts such as symmetry, right angles, and the relationship between parallel and perpendicular lines, are embedded in Silam Sakma's design, providing an engaging way to teach mathematics, making it culturally relevant and fostering a deeper connection to one's heritage. Moreover, by preserving these traditional practices, future generations not only continue the spiritual significance of Silam Sakma but also carry forward a legacy of indigenous knowledge, blending it with modern educational methods. Thus, the Silam Sakma serves as a powerful reminder of the importance of protecting cultural artefacts. By safeguarding and promoting Silam Sakma, the Limbu community ensures that their rich legacy intertwined with both cultural symbolism and mathematical knowledge that remains intact for future generations, reinforcing the significance of indigenous heritage in a rapidly changing world.

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