

## Becoming (De)Contextualized Learners and Teachers of Mathematics: An Arts-Based Ethnodrama

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*Abstract: Grounded in living educational theory, socio-cultural theory, and transformative learning theory, this inquiry investigates the professional growth of the first author, Hem, from a traditional practitioner to a critical and culturally aware mathematics educator. This inquiry examines critically (de)contextualized mathematics learning and teaching to envision a pathway toward becoming a transformative learner and teacher, while also investigating the mathematical concepts learners develop through contextually grounded instruction. The study is structured around the research question: How has Hem developed as a contextualized learner and mathematics teacher? The research employs an auto-ethnographic methodology, drawing upon Hem's personal experiences as a learner, teacher, and educational researcher. The study employs an arts-based approach to facilitate this investigation, subscribing to an ethnodrama. This method is a distinct form of dramatic literary expression, constructing a theatrical setting across three acts where the authors and participants engage in collaborative performance. We critically reflect on past experiences and analyze the applications of cultural heritage as a contextualized framework for mathematics instruction. The study presents a critical self-investigation for integrating personal narrative and cultural context in mathematics education. This inquiry calls for curricular reform and teacher development in Nepal to foster more inclusive and empowering mathematics education.*

Keywords: ethnodrama, transformative learning, ethnomathematics, mathematics education

### INTRODUCTION

This article originates from a section of the first author's MPhil dissertation in mathematics education, with contributions from the second, third, and fourth authors. The third and fourth authors, Indra and Ruma, served as the second and first supervisors, offering various perspectives from inception to the finalization of the article. The second author, Niroj, helped me shape and reshape the article at the publication level by offering critical comments throughout the article. The article explores methods for teaching and learning mathematics both inside and outside the classroom, aiming to help teachers become contextualized, culturally aware, and responsible mathematics educators. Using a narrative inquiry technique, we have concentrated on Hem's experiences and opinions regarding the nature of mathematics while working as a math teacher in Surkhet Valley, Nepal. Hereafter, we have used the first person

'I, me, my' to embody Hem's reflections and perspective in the article. We begin this article with the following vignette:

"I practiced it many times, but it did not get into my head. Sir, is memorization a good technique for understanding mathematics?"

Reflecting on the vignette above, it continues to resonate in my mind. I have taught mathematics at the school level for over ten years, yet I still consider myself a novice in mathematics education. I work as a researcher, educator, and teacher at a school and university in Nepal. Throughout my career, I have encountered various teaching and learning techniques. In this context, Dhungana et al. (2023) noted that "teaching and learning mathematics in Nepali schools is not as fruitful as expected" (p. 186). This observation prompted me to reflect critically on my beliefs and experiences regarding mathematics education. My postgraduate studies have also exposed me to various research approaches, including multi-paradigmatic and critical autoethnographic methods, which can enhance my teaching and learner practices. These experiences have motivated me to envision better alternatives for achieving more effective outcomes (Dhungana, 2023). Inspired by my life experiences, I am committed to transforming from a decontextualized mathematics teacher to a culturally contextualized one.

So far, as a learner, from my earliest academic endeavours, my pursuit has been unwaveringly focused on attaining superior grades in school mathematics. As a teacher, I initially held the conviction that teaching mathematics involved delivering information to my students, who were seen as passive learners. I held onto this viewpoint until 2010, when I enrolled in a Master of Education (Mathematics) program. As a novice researcher, I was eager to explore my previously undisclosed personal experiences and contradictions (Whitehead, 2008), aspects of school mathematics teaching and learning, and to share them with the world. I came to realize, as a passive recipient of knowledge, that what my teachers conveyed as they transmitted from the mathematics textbook was a collection of culturally decontextualized knowledge that did not encompass my own cultural experiences. My practices of decontextualization turn a real situation into abstract symbols, thereby working with those symbols as if they are separate from their original context. Contextualizing means pausing during this process to consider what those symbols represent in the real world (Lee, 2025; Yeea & Bostic, 2014). I have actively participated in research, which has led to a restructuring of my teaching perspective. I understand my responsibility to promote a meaningful understanding of learning mathematics by encouraging my students to incorporate their cultural knowledge into the classroom.

With all of the above, this article aims to demonstrate my investigation into the enduring issue of culturally contextualized mathematics in promoting meaningful classroom learning, incorporating the ethnomathematics perspective. Hallden (1999) explains that contextualizing a problem can involve connecting it to a real-life scenario and linking it to other concepts or ideas. Utilizing ethnodrama, the authors aim to enhance readers' critical awareness of the importance of crafting culturally contextualized mathematics education. Additionally, we aim to encourage the development of readers' critical reflective thinking to bring about transformations in their pedagogical and curricular practices. This inquiry addresses the following research question:

- How have I (Hem) been developing myself as a contextualized learner and mathematics teacher?

## LITERATURE REVIEW

As a practitioner-researcher, teacher-educator, and educator, I have initiated a thorough examination of accepted theories in my profession. I have learned that there is not just one "royal road" to transformative teaching. I find value in locally produced frameworks that address my research needs as well as the needs of others, rather than relying exclusively on broad theories. Furthermore, it makes sense for me to select Vygotsky's Socio-cultural Theory (Vygotsky, 1978), Transformative Learning Theory (Mezirow, 1997), and Living Theory Methodology (Whitehead, 2008). Transformative research adopts a comprehensive perspective, enabling researchers to formulate inquiries that span multiple paradigms, with the goal of reshaping educational policy and practice (Dahal, 2024; Paudel et al., 2023; Taylor et al., 2012). Living Educational Theory is a potent instrument for self-awareness and career advancement in this research study. It prompts me to consider the essential question, "How can I improve my practice?" I explore my journey as a mathematics teacher and educational researcher through reflective narratives, drawing on Living Education Theory. I describe my current teaching and learning methods as I become more conscious, fusing my goals, experiences, and insights. It enables me to develop, refine, and make significant contributions to the field of education through my academic work.

This study used socio-cultural theory (Vygotsky, 1978) to perceive teachers' conceptual understanding of contextualization and how they implement it in the teaching-learning process through social interactions and the culture of learning. In addition, I applied socio-cultural theory to my study to improve students' comprehension of teaching and learning activities and leveraged insights into how students learn. Understanding that students learn differently from one another is crucial. I have chosen socio-cultural theory as one of the theoretical frameworks for my study to delve more into this. My stories familiarized me with the Zone of Proximal Development (ZPD) (Vygotsky, 1978). I used it frequently to enhance my understanding of mathematical concepts. Transformative Learning Theory supplied new ontological, epistemological, and axiological underpinnings for research orientation (Luitel & Taylor, 2007; Mezirow, 1997; Pant, 2019). From an ontological perspective, it made it easier for me to incorporate various worldviews into my own, resulting in a shift from my existing state of being to a more pleasant state through critical self-reflection. Epistemologically, my instrumental knowledge shifted to communicative knowledge, aligning with the principles of transformative learning theory. Axiologically, this broadened my understanding, combining instrumental and communicative knowing, ultimately promoting contextualization in mathematics education through transformative pedagogy.

## METHODS

This study used a qualitative research design based on an arts-based auto-ethnographic approach aligned with Hem's experiences as a learner, teacher, teacher educator, and educational researcher from an early career. The primary methodological framework is ethnodrama, which serves as both the process of inquiry and the mode of representation. This approach is chosen to critically and evocatively explore the first author's (Hem's) transformative journey from a decontextualized to a contextualized perspective as a mathematics educator.

## Research Paradigms

The inquiry is situated within a multi-paradigmatic research space, guided by interpretivism, criticalism, and postmodernism. The interpretive paradigm facilitates a deep understanding of the meanings Hem assigns to his experiences as a learner, teacher, and researcher (Shrestha, 2018). The critical paradigm challenges dominant, transmission-based models of mathematics education and questions the assumptions underlying decontextualized pedagogy (Brookfield, 2000). Ultimately, a postmodern lens enables the acceptance of multiple, subjective truths and alternative forms of expression, such as narrative and metaphor, to represent the complexity of lived experience (Denzin & Lincoln, 2005).

## Auto-Ethnographic Approach as Research Method

Subscribing to auto-ethnography (Ellis et al., 2011; Spry, 2001), this method involves a systematic (self-)study of Hem's personal and professional experiences within the cultural context of mathematics education in Nepal, particularly in the Surkhet Valley. As an auto-ethnographer, Hem critically reflects on his own "living contradictions" (Whitehead, 2008)—the tensions between his past practices as a traditional teacher and his evolving identity as a culturally responsive educator. This process treats the self as the primary data source, with personal narratives serving as the evidentiary base for analyzing broader cultural patterns and pedagogical possibilities.

## Ethnodrama as Methodology and Representation

To operationalize the auto-ethnographic inquiry, we subscribed to an arts-based approach by crafting an ethnodrama (Saldana, 2011). Ethnodrama transforms ethnographic data—in this case, autobiographical memories, reflective journals, and dialogue from Hem's teaching practice—into a dramatic script. This method was selected for its capacity to engage readers emotionally and intellectually, moving beyond a traditional analytical report to a performative, evocative representation of the research findings. The ethnodrama is structured in three acts, each corresponding to a key theme in Hem's developmental journey:

1. *Act I: Step-by-Step Memorization* dramatizes the limitations of rote learning and decontextualized mathematics instruction.
2. *Act II: Mathematics in My Religious/Cultural Texts* explores the discovery of sophisticated mathematical concepts within Hindu epics (e.g., the Ramayana, Mahabharata) and scriptures, challenging the dichotomy between academic mathematics and cultural knowledge.
3. *Act III: Mathematics in Religious Places* illustrates the practical application of local cultural artifacts (e.g., temple symbols, Pipal leaves) to teach abstract mathematical concepts like symmetry.

Each act presents dramatized vignettes constructed from Hem's lived experiences. The script format includes stage directions, dialogue, and the internal monologue of the "Storyteller Researcher" (Hem), creating a theatrical setting that invites the audience (readers) into a collaborative performance of meaning-making.

### Data Collection and Analysis

Data for this self-study were drawn from Hem's extensive personal archive, which includes:

- Autobiographical memories from his time as a student and teacher.
- Critical incident journals documenting specific classroom interactions and moments of professional dissonance.
- Reflective narratives written during his MPhil studies catalyzed a transformative perspective.
- Dialogues with students, colleagues, and community members (e.g., a Pandit) were reconstructed for the dramatic script.

The analytical process was iterative and reflective, aligning with the principles of living educational theory (Whitehead, 2008). Data were analyzed through critical self-reflection, focusing on the central research question: *How have I (Hem) been developing myself as a contextualized learner and mathematics teacher?* Thematic analysis was used to identify recurring patterns and key turning points in Hem's understanding, which were then organized into the three thematic acts of the ethnodrama. The scripting process served as a form of analysis, as selecting, structuring, and dramatizing the narratives required deep interpretation and crystallization of the core insights.

### Ensuring Rigor and Addressing Ethical Issues

As an auto-ethnographic study employing an arts-based methodology, this inquiry operates outside the traditional criteria of validity and reliability used in positivist research. Instead, we have prioritized trustworthiness, authenticity, and ethical reflexivity throughout the research process (Lincoln & Guba, 1985). Ensuring rigor in such subjective and performative study requires deliberate and continuous engagement with specific practices.

### Ensuring Rigor

We employed several strategies aligned with arts-based and qualitative research paradigms to establish the credibility and authenticity of the narratives and dramatic representations. The research process was grounded in critical self-reflection, a core tenet of Living Educational Theory (Whitehead, 2008). As the primary author and subject, Hem continuously interrogated his assumptions, biases, and positions of privilege as a Brahmin male, a teacher, and a researcher. This involved maintaining a detailed reflective journal to trace the evolution of his understanding, ensuring that the narratives presented in the ethnodrama were not merely recollections but critically examined accounts of his lived experiences (Dahal, 2023). While the study is auto-ethnographic, it is not solipsistic. The research was shaped through dialogue and critical feedback from the co-authors, who served as supervisors and critical friends. Their diverse perspectives—offering "various perspectives from inception to the finalization of the article"—acted as a form of triangulation, challenging interpretations and enriching the analysis. Furthermore, the narratives incorporate the voices of students, a Pandit, and a friend, providing multiple vantage points on the phenomena of (de)contextualized learning. The ethnodrama offers a "thick description" (Geertz, 1973) of the cultural contexts, including detailed accounts of the Hindu epics, religious practices, and classroom interactions. This rich-

ness allows readers to vicariously experience the settings and judge the transferability of the insights to their own contexts. For instance, the detailed dialogue with the student Prakriti about symmetry offers a concrete example of the pedagogical shift being advocated.

A key goal of this research is to explore its transformative potential, aligning with Transformative Learning Theory (Mezirow, 1997). Therefore, the criterion for success is accurate representation and catalytic authenticity—the ability to provoke reflection and inspire action in the reader (Dahal, 2023; Saldana, 2011). The ethnodrama format is specifically chosen for its *verisimilitude*, or "lifelikeness," aiming to create an emotional and intellectual resonance that encourages educators to critically examine their own practices. The question posed at the end of Act II—"Is it contextualized mathematics?"—is deliberately left open to stimulate this reader-response.

### Addressing Ethical Issues

Conducting research that delves into personal memory, cultural traditions, and pedagogical practice necessitates a vigilant approach to ethics (Dahal & Luitel, 2022). Although this is an auto-ethnography, it involves other participants. The students, the Pandit, and the friend mentioned in the acts are anonymized using pseudonyms (e.g., Prakriti, Dinesh, Mahesh) to protect their identities and confidentiality. While the specific school in Surkhet Valley is not named, the cultural context is essential to the study. We have striven to present this context in a way that honors its integrity without exposing individuals or institutions to any risk. A significant ethical consideration involves the representation of Hindu religious texts (Ramayana, Mahabharata, Upanishads) and practices. We have approached these cultural elements not as objects of exotic scrutiny but as legitimate sources of mathematical knowledge (ethnomathematics). The intent is to affirm and integrate cultural heritage into academic discourse, thereby challenging the hegemony of Western, decontextualized curricula. We have described these elements accurately and respectfully, drawing on established interpretations. auto-ethnography requires a significant degree of vulnerability from the researcher (Adams & Holman Jones, 2008; Dahal & Luitel, 2022; Ellis et al., 2011). Hem's narrative exposes past pedagogical shortcomings and personal struggles with mathematics. This self-exposure is a deliberate ethical and methodological choice, intended to present an honest, authentic account of professional growth. The risk of self-indulgence is mitigated by framing the personal within broader theoretical and social concerns about mathematics education, ensuring the work contributes to a larger scholarly and practical conversation. Thus, this research aims to improve mathematics education for Nepali students by making it more inclusive and meaningful. We have been mindful to avoid any representation that could cause harm, misrepresent cultural practices, or reinforce stereotypes. The critique of rote learning is directed at systemic pedagogical practices, not individual teachers or students, who are often products of the same system.

### DISCUSSIONS

Based on the formulated problem, purpose, and methodological roadmap, we have attempted to discuss acts aligned with the themes of culturally (de)contextualized mathematics in subsequent acts.

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### Act I: Step-by-Step Memorization

The director addresses the audience, informing them that Act I will commence shortly and briefly explaining the nature of the upcoming drama.

Whistle sounds, background music, and stage lights on

*Storyteller researcher:* "I practiced it many times, but it did not get into my head.

Sir, is just memorization a good understanding technique ...?"

This was my voice on the first day of my master's degree in the Algebra class. After that, my teacher smiled at me and said that understanding and memorizing are two different things. Sometimes, understanding comes by memorizing. Go this way. You may get your aim. It was the year 2010. I hold a master's degree in mathematics education from the Central Campus of Education, Kirtipur. I would fear Abstract Algebra. My seniors told me that algebra is the most challenging subject. My teacher starts that course from "Group Theory". He teaches the definition of a theorem in each chapter. I remember that day, my Algebra teacher taught us about "Cyclic Group" and he moved to this content/chapter as a definition of the theorem. When I wrote the definition of a cyclic group in the classroom, I memorized that definition but did not understand. I questioned myself: How can I know that definition? Is this definition learned in a real-life situation? After that, my teacher taught a theorem. He wrote a theorem on the whiteboard and proved it. He used that definition of a cyclic group to prove the related theorem.

I am thinking and realize a couple of minutes...

"...understanding a definition is more effective than rote memorization when proving related theorems. In my experience, I wouldn't fully grasp a theorem without first understanding its definition. Moreover, learning mathematics with an emphasis on understanding involves making connections among different ideas. These connections help facilitate the transfer of prior knowledge to novel situations. I argue that rote memorization does not reflect true understanding."

It was in July 2016, when I was a new teacher at a reputed private boarding school in the Surkhet Valley. It was like a paradigm shift for me when I changed schools. During that time, I would teach the *Matrix of Basic Mathematics* class. I started this chapter with a definition of a Matrix and its examples. After that, I defined various matrices with examples, including Row Matrix, Column Matrix, Square Matrix, Diagonal Matrix, etc. At the end of that class, I assigned the task of memorizing the definition of a Matrix and its various types. The next day I asked them some definitions I had already taught yesterday. Some students find it easy to define. Most students did not explain their points clearly; they often skipped one or two sentences or words. For example, one student describes a Diagonal Matrix: A matrix is considered a diagonal matrix if all elements except those on the main diagonal are zero. However, the correct definition is that of a diagonal matrix: A square matrix is considered a diagonal matrix if all elements except those on the main diagonal are zero. Here, the word "square" is skipped in that definition. Similarly, some students incorrectly define Upper Triangular and

Lower Triangular Matrices. They were wrong, such as the incorrect use of "above instead of below" and "below instead of above" in that definition.

For an upper triangular matrix, a student's response is 'A square matrix in which all elements above the main diagonal are zero is called an upper triangular matrix.' However, the correct response is, 'A square matrix in which all elements below the main diagonal are zero is called an upper triangular matrix.' Likewise, for a lower triangular matrix, a student responds as 'A square matrix in which all elements below the main diagonal are zero is called an upper triangular matrix. Though the correct response is 'A square matrix in which all elements above the main diagonal are zero is called a lower triangular matrix.' Most students made conceptual errors when defining upper- and lower-triangular matrices. Although some students attempted to state the definitions, they often confused the positions of the zero elements relative to the main diagonal or mislabeled the matrix type. In addition, several students provided definitions without supporting examples, which suggests that their understanding may have relied largely on rote memorization rather than conceptual comprehension. As researchers and teachers, this observation raises several reflective questions: Why do students tend to memorize definitions mechanically? Why do they struggle to interpret the meaning behind these definitions? These questions highlight a broader pedagogical issue. When definitions are learned only through memorization, students may reproduce the wording but fail to understand the structural idea underlying the concept. Therefore, teaching mathematical definitions through visual representations, examples, and contextual or real-life connections may help students develop deeper conceptual understanding rather than merely recalling statements. This approach can support meaningful learning definitions and other mathematical concepts that are often taught through memorization alone.

Now, I believe that memorization alone is not a good understanding technique. We could have understood the matter more conceptually if it were taught in relation to a daily life problem in mathematics. In the past, the learning process was teacher-centric; students were rarely motivated to learn through the concept of the learning-by-doing approach. According to modern learning innovations, teachers are facilitators, and students are their own teachers. As a facilitator, they facilitate the learning process, enabling students to be more critical of it.

Typically, there are two primary methods of learning: the surface learning strategy and the deep learning strategy. Surface learning involves memorizing information without delving into deeper comprehension, often referred to as rote learning. On the other hand, the deep approach involves immersing students in the study process to thoroughly understand the subject matter. Rote memorization is a prevalent practice across educational levels, emphasizing the memorization of content rather than its comprehensive understanding and application to real-life situations. Rote learning is simply storing data in the brain; it doesn't require understanding the data being stored. Rote learning is often employed when there is an inadequate level of foundational knowledge. This approach to learning is highly effective when dealing with information of temporary urgency, such as memorizing phone numbers or addresses. However, relying solely on rote learning is highly ineffective in mathematics. Mathematics involves abstract concepts, necessitating a profound understanding rather than mere memorization. Mastery of mathematical concepts is crucial, with a focus on comprehension rather than memorization. The result of applying the rote learning method is that students formally know a concept, but because they do not understand it, they will be unable to use it to solve their

daily problems. Additionally, the rote learning method does not involve any cognitive activities at all.

I would learn and teach using the traditional decontextualized method as a learner and teacher (see Dhungana et al., 2024; Dhungana et al., 2025). I added that the mnemonic technique stifles creativity (this memory technique is primarily used when memorizing lists, names, numbers, or vocabulary in a foreign language) when we teach in a decontextualized way in the classroom. In addition, I would learn and teach by rote learning methods, such as memorizing step by step. Sometimes I would memorize the definition of a mathematical topic by learning and reciting many formulae one by one. In my view, rote learning kills creativity in mathematics content. From what I have observed, I believe that decontextualized learning helps students memorize mathematical formulae for tests; however, they will likely forget formulae memorized from lists rapidly. These ideas seem to be accepted by rote memorization.

Although Shrestha (2019) concludes that rote memorization and practice methods have created students as mechanistic learners disadvantaged of conceptual and meaningful learning due in no small way to culturally decontextualized mathematics syllabuses, from my teaching-learning experiences, now I believe that the rote memorization method did not develop creativity; it develops some skills to memorize formulae, definitions, or some steps of theorems. Therefore, I conclude that rote memorization produces students who are mechanistic learners, much like parrots. The first session is successful. 15-minute break!

Background music off, curtain comes down.

## Act II: Mathematics in My Religious/Cultural Texts

The director addresses the audience, informing them that Act II will commence shortly and providing a brief explanation of the upcoming drama.

Whistle sounds, background music, and stage lights on.

*Storyteller researcher:* I remember my childhood when I belonged to a Brahmin family. My father had a daily routine of prayer. He recited the Mantras of Hindu epics, such as the Mahabharata, Ramayana, and Gita. These Ślōka and Mantras are still striking on my mind. I still remember some of the Mantras. One of the Mantras that I remember is from the Ramayana. In the Sundarakanda of the Ramayana, in Sarga 35, Verses 17-21, Hanuman comprehensively describes various aspects of Shri Rama's physique and character, as shown in Figure 1. In addition, Hanuman elaborates on Rama's eyes, his qualities, intellect, reputation, adherence to social norms based on the four castes (Brahmana, Kshatriya, Vaishya, and Shudra), and his dedication to upholding righteousness. He recounts Rama's assistance to ascetics, his promotion of righteous actions, and his exceptional prowess in archery, among other attributes. Hanuman, the expert scholar, as he was knowledgeable in the Samudrikalakshanas or characteristics and traits of great men, briefly described the bodily features by merely indicating them using numbers such as 4, 3, 14, 5, 10, 2, 6, and 9 (M.M., 2020). Similarly, that day I re-

alized that we do not have a television in our home. During my childhood, the television serials Ramayan and Mahabharat were broadcast on the Indian television channel Doordarshan. My parents watched these shows every evening, and I often joined them. Together we watched almost all the episodes, and these stories gradually became part of my early cultural and religious understanding. These early experiences shaped my curiosity about the philosophical and moral lessons embedded in these epics. Years later, as a researcher, I found myself reflecting on these childhood memories during a visit to Padam Prakaseshower Mahadev Temple, where I met a pandit. Our conversation naturally turned to the very epics I had watched as a child. The pandit shared many stories from the Ramayana, Mahabharat, and the Bhagavad Gita, elaborating on their meanings and moral teachings. He also gave me a small book containing narratives and summaries of these texts, including a summary of the Ramayana that I mentioned earlier. Through this interaction, I revisited the stories that had once been part of my childhood television experience. Our discussion deepened my understanding of these epics, and I realized that I was already familiar with several ślokas and bhajans related to the Ramayan, Mahabharat, and the Bhagavad Gita, which had become part of my cultural memory over time.

This *Sloka* is a better example of a number system in the Ramayana. Hanuman cautiously describes the abstract divine form of Rama using a number system. According to the general understanding of devotees, it is impossible to describe the manifestation of God in its divine form. But in reality, Human, a major character in Ramayana, describes Rama's characteristics in its divine form.

As a researcher, I believe that religious scripture is not different from the mathematical rules. These can be better articulated through mathematical concepts. I still remember one of the scriptures that the father frequently recited during prayer. The Svetaśatara Upanisad (5.9):

*“balāgra-sata-bhagasya śatadhā kalpitasya ca bhago  
fiuah sampeyah sacdnannya kalpate”*

This scripture explains the nature of the soul, which is eternal and never dies. Translated it says, “When the upper point of a hair is divided into one hundred parts and again each of such parts is further divided into one hundred parts. Could we do it? No. That is not possible. But each such part measures the aspect of the spirit soul. There are uncountable particles of spiritual atoms, which are measured as one ten-thousandth of the upper portion of the hair.”

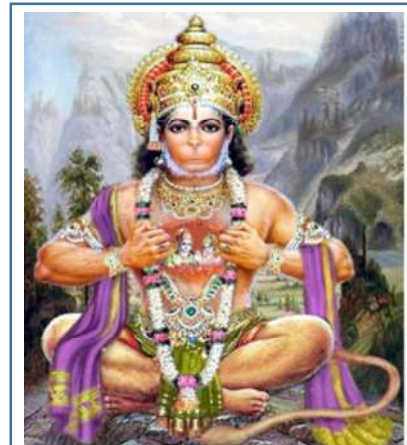


Figure 1: Hanuman

Hence, the spiritual essence within each living being exists as a minute spiritual particle, smaller in size than a material atom, and these spiritual particles are countless. This tiny spiritual spark serves as the fundamental element of the physical body, with its influence permeating throughout the body, much like the effects of a medicinal active principle spread throughout the body. As a researcher, I believe that the rules of mathematics are the ultimate way to understand every mystery in human life. As a novice educator, I question whether school mathematics can be easy for students according to the above scripture. During those days, I was unaware of the meaning of this verse. While I began searching for mathematics in

religion, I found this Ślōkā to be very amazing in describing the measurement of the soul. I am so surprised and wonder how the religious scripture scaled the soul in its tiny form? It prevents a person from understanding religious arguments in a superstitious way. One can understand religion logically by applying mathematics. The divisions, multiplication, and subtraction are the general mathematical rules used to understand the spiritual affairs of human life.

I realized that religious content should be included in the school curriculum to broaden the concept of mathematics and explore the intersection of science, religion, and culture. My daughter often watches the Mahabharata serial on television. She oversees it and shares it with her family. I realized that if the level curriculum incorporated the story of this Hindu epic, illustrating the mathematical concept, it would facilitate students' learning of mathematics. Therefore, religious scripture should be connected to mathematics teaching. Furthermore, expanding the scope of mathematics would help distance people from superstitious beliefs in religion.

While studying in class 10, my father told me about the 'Chakravyuh' in the *Mahabharat*. My father and mother would discuss it interestingly, but I couldn't understand the concept. I knew that the 'Chakravyuh' was created by a great teacher of the Mahabharata era, Dronacharya, to imprison the Samrāṭa *Yudhishtira* on the battlefield, distracting Arjun from the battlefield, as shown alongside in Figure 2. Arjun was the only one who knew all about *Chakravyuh*. He was skilled enough to enter Chakravyuh and exit it successfully. On the day of the creation of



Figure 2: Chakravyuh

*Chakravyuh*, Samrāṭa Yudhishtira was in tension. Abhimanyu sought permission to enter the battlefield, revealing that he had learned half the strategy of penetrating the Chakravyuh while still in his mother's womb. Although he knew how to join the Chakravyuh, he was unaware of the exit strategy.

Knowing this, Bhīma and the other Pāṇḍava prepared to support him, and he penetrated the Chakravyuh on the battlefield and entered it. During the war, Abhimanyu showed great valor and defeated many soldiers of the Kauravas' army. He defeated mighty warriors like Karna, Duryodhan, Kripacharya, and Ashwathama. Here, Bhīma and the other Pāṇḍavas attempted to enter the Chakravyūha, but Jayadratha did not let them in. Unfortunately, he was killed so mercilessly by great warriors, violating the rules of war. Moreover, I knew the story of *Chakravyuh*, but I could not have realized its mathematical significance in my life.

However, one day while researching my MPhil program, I met my friend and enquired about the mathematical concepts in *Mahabharata*. In response to my question, he suddenly suggested that I explore Chakravyuh in the Mahabharata epics. Upon receiving that suggestion, I began to research it, and I found it too interesting and inspiring to study.

Chakra means "spinning wheel," and "vyuan" means formation. Hence, chakravyuh refers to the intricate plan of soldiers that involves moving in a circular formation, similar to a spinning wheel, as illustrated in Figure 3. In mathematics, this concept is represented by concen-

tric circles. Additionally, the rotation of soldiers is similar to the helix of a screw, commonly seen in watches. The Chakravyuha is a multi-tiered protective plan that resembles a disc (chakra) (TMR, 2020).

The mathematical concept of the *Chakravyuha* is a circle of proportion or concentric ripple circles. A circle of proportion is a slide rule that helps calculate additions, subtractions, divisions, multiplication, exponential, logarithmic, and, to some extent, even trigonometry. It is composed of concentric circles, which are divided proportionally using arcs and tangents, and the pieces rotate in unison to facilitate calculation.

As a researcher, I realized that Chakravyuh is one of the most effective mathematical concepts applied in ancient wartime periods, particularly in the Mahabharata. Mathematics helps solve problems; it has also been an inherent part of a decisive, war-prone world, helping to establish truth in a devil-ridden world. The Mahabharata war was fought for truth and justice, and mathematics was crucial in developing strategies to defeat the enemy.

In addition, mathematics is universal. Be it business, architecture, design, engineering, nature, or even our religious texts. The Vedas, Upanishads, and Puranas provide evidence for the use of large numbers, fractions, infinity, and zero. Advanced mathematical concepts are discussed in the two great Hindu epics, the Ramayana and the Mahabharata. Besides, many instances in the Bible, the Quran, and other scriptures speak volumes about their richness (Thakur, 2016). In Jaina mathematics, many topics on mathematics are discussed in the Sthananga Sutra, such as arithmetic operations like multiplication, division, subtraction, addition; Number Theory; Geometry; Mensuration of solid objects like spheres, cylinders, etc.; fractions; Solving linear, quadratic, cubic, biquadratic equations, laws of indices, and Permutation & Combinations. Like people from the Vedic period, Jaina mathematicians were also involved in cosmology in large numbers (Bhangale, 2013).

I agree that religion is not separate from rigorous mathematical concepts. It has carefully applied these concepts to its authenticity and legitimacy. The religious texts convince the followers that they hardly think critically about it. It could not have been possible in the absence of mathematics. Therefore, it would be beneficial if both school and university curricula incorporate mathematics in relation to religion and cultures to culturally contextualize academic mathematics, which may help make mathematics learning more authentic, empowering, inclusive, and justifiable. I believe that including such contextual mathematics also helps students feel a sense of ownership over their learning. As a novice mathematics teacher, I question myself: Is it contextualized mathematics?



Figure 3: Chakravyuh

The second session is successful. 15-minute break!

Background music off, curtain comes down.

### Act III: Mathematics in Religious Places

The director addresses the audience, informing them that Act III will commence shortly and providing a brief explanation of the upcoming drama.

Whistle sounds, background music, and stage lights on

Storyteller researcher: As a member of a Hindu family, I am well-versed in the practices of Hindu culture. Going back to my childhood, I would accompany my father to the temple and other Hindu religious sites. I recall that I would observe the religious monuments with great curiosity. At the same time, several questions would arise in my mind regarding the objects surrounding these religious sites. I would question the nature, characteristics, and meanings of these objects.

It could be any day of October 2019. I was a mathematics teacher at a secondary-level school in Surkhet. I recall when I was teaching the curve sketching chapter, one of my students expressed confusion about symmetry. Her main problem was the conceptual understanding of symmetry for curve sketching. I present the brief dialogue below:

Student: *Sir! Your teaching is nice to me, but I am still getting confused about the symmetry of curve sketching.*

Teacher: *It's ok, Prakriti! Let me make it clear to you.*

Student: *Thank you, sir!*

Teacher: *Ok! Listen here..... (I described the definition of symmetry with an appropriate example.)*

Teacher: *Symmetry is a characteristic of curve sketching. A curve represented by the function is symmetric about the y-axis if no change occurs in  $f(x)$  when  $x$  is replaced by  $-x$ , if  $f(x)$  is an even function. In this case, the parts of the curve lying on either side of the y-axis are the same.*

Similarly, a curve represented by the equation  $f(x, y)=0$  is symmetric about the x-axis if no change occurs in the equation when  $y$  is replaced by  $-y$ . At last, a curve represented by the equation  $y=f(x)$  is symmetric about the origin if  $f(-x)=-f(x)$  that is an odd function.

For example: Test the symmetry of the function  $f(x)=x^2$ .

For the solution, I used the definition of symmetry about the x-axis, symmetry about the y-axis, and symmetry about the origin as given below:

Given function is  $f(x)=x^2$

Here,  $f(-x)=(-x)^2=x^2=f(x)\Rightarrow f(-x)=f(x)$

So that is symmetric about the y-axis.

After that, I finished my class. When I return home in the evening, I ask myself: How can I teach those students who do not understand easily? At midnight that day, I found an idea of how to teach about the symmetry of a function as a leaf of the *Pipal*. The next day was Monday. My wife fasted on that day. I was going to the temple with my wife in the morning. After that, my wife starts to pray to Lord Mahadeva. At that time, my eyes found a picture of God Mahadeva and Parbati, two in one. And I uttered myself: *Wow... this may be the best example of symmetry*, shown in Figure 4.

I think ..... After that.....

Me: *Good morning, all of you.* (I take a leaf of Pipala and a picture of Lord Mahadeva and Parbati)

Students: *Good morning, Sir!*

Dinesh: *What is in your hand, sir?*

Me: *Yes! I have two things to share with you. Please look at me attentively.*

Dinesh: *Wow! What a nice sir!*

Me: *Yes!*

Me: *Symmetry is the balanced distribution of duplicate shapes. The word 'symmetry' means dividing an object into two equal parts so that one part coincides. When examining plants and animals, we observe that they possess symmetrical body parts or shapes.*

Symmetry is a significant geometrical concept often observed in nature and applied in every field of our daily life. Artists, manufacturers, designers, architects, and others use the idea of symmetry. Leaves, flowers, clothing, mats, handkerchiefs, and utensils often feature symmetrical designs. (After showing a leaf and a picture of Lord Mahadeva and Parbati....)

Me: *Look at this leaf, if we divide the leaf in half, we often find that one half has the same shape as the other. Symmetry exists all around us, and many people find it beautiful.*

Me: *Likewise, look at the picture of Lord Mahadeva and Parbati as one in the same. From it we conclude that there is symmetry about the vertical line, and the line divides the picture into two parts.*

Mahesh: *Woo... its really interesting sir!*

Prakriti: *Sir! Now, I understand.*

Me: *Yes! Prakriti.: Tell me, what is symmetry about the x-axis, symmetry about the y-axis, and symmetry about the origin*

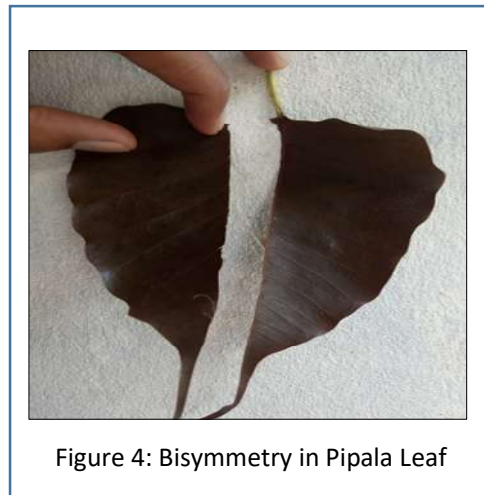


Figure 4: Bisymmetry in Pipala Leaf

*After that, she said all the definitions of*

*symmetry.*

(after .....her answer about symmetry)

Me: .....*Good! Prakriti.*

After that I take an example which is given below:

Example: Test for symmetry of the function  $f(x)=x^2$ .

For solution, at first I start for testing as,  $f(x)=x^2$

Here, it is clear that  $f(x)$  is symmetric about the y-axis, shown below in Figure 5.

$$f(-x)=(-x)^2=x^2=f(x)$$

$$\Rightarrow \Rightarrow f(-x)=f(x)$$

Now, look at the following table how  $f(x)$  seems symmetric about the y-axis.

X	1	-1	2	-2	3	-3
Y	1	1	4	4	9	9

We have to plot six points: (1, 1), (-1, 1), (2, 4), (-2, 4), (2, 4), (3, 9), and (-3, 9).

If  $X = 0$ , then  $y = 0$ , so  $f(x)$  goes through the origin. We need to plot the point (0, 0).

Now, I have realized that learners find it easy if we teach with the help of locally available materials. I think the learner is well-versed in local materials and hence feels it is easy to learn mathematics meaningfully. Therefore, as a researcher, I argue that students need to be familiar with the mathematical concepts found in various objects and materials available in their surroundings. As I discussed above, certain objects and materials that facilitate grasping the concept of mathematics, such as geometry and algebra, are crucial for conceptually learning mathematics. Contextualization refers to the teaching of mathematics problems that highlight real-life situations. For example, a teacher could develop a contextualized task on exponential functions and equations by having students work on an Internet-based task to determine the monthly payment for a new car at a given price and interest rate for a specific loan duration.

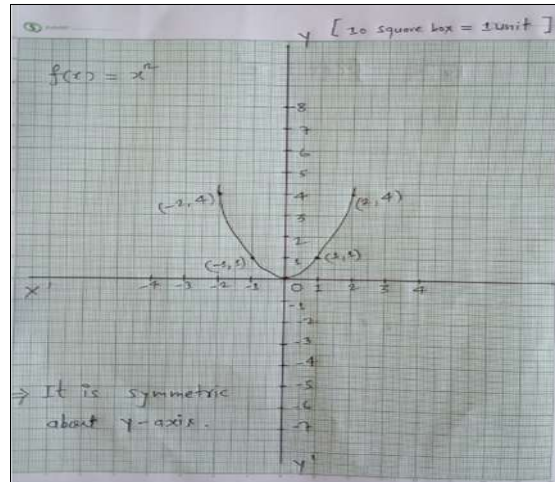


Figure 5: Curve with Symmetry about y-axis

In this example, teachers would teach students how to compute with exponential formulas to calculate the monthly amount. Additionally, contextualization is defined as the development of mathematics problems that are authentic and related to real-world applications that are connected to students' future careers (Bottge & Cho, 2013). It is true that for the sustainability of learning, it needs to be linked with daily life experiences. That is why the contextualized

mathematics will be decisive for permanent learning. Ok, this is enough today! The workshop concludes.

Background music off, curtain comes down.

## REFLECTIONS AND INSIGHTS

This study investigates the limitations of culturally decontextualized mathematics education in Nepali schools and advocates for a transformative, ethnomathematical approach. Traditional mathematics instruction in Nepal often focuses on rote memorization and algorithmic problem-solving, failing to engage students meaningfully or reflect their lived experiences. As classrooms grow increasingly diverse, many students arrive unprepared to learn due to socio-emotional and economic challenges (Barbara, 2000). From a Vygotskian perspective, this decontextualized approach ignores the fundamental role of culture and social interaction in learning, failing to build upon students' unique "funds of knowledge."

So, as defined by Paris (2011), culturally contextualized pedagogy leverages students' existing knowledge and community experiences to make learning more relevant. Ethnomathematics offers a framework for integrating cultural practices into mathematical instruction, fostering understanding and critical awareness (Rosa & Orey, 2007). As Stigler and Baranek (2014) note, mathematics is a body of knowledge shaped by diverse cultural contributions over time. Research and classroom experiences reveal that contextualized instruction enhances student engagement and comprehension. Tomlinson et al. (2003) emphasize the importance of aligning instruction with students' readiness, interests, and learning styles. However, in Nepal, mathematics is still taught as a rigid, abstract discipline, disconnected from real-life applications. Nilsson and Ryve (2010) found that teachers often interpret contextualization narrowly, focusing only on using local materials rather than integrating broader cultural narratives.

This study emphasized the need to reform the mathematics curriculum in Nepal to incorporate ethnomathematical principles. Such reform would improve conceptual understanding and challenge the dominance of reductionist pedagogies that prioritize exam performance over meaningful learning. The prevailing belief among parents and schools—that mathematics is solely about calculation and exam success—further entrenches this issue. This research, grounded in my Living Theory methodology, illustrates through reflective practice and ethnodrama how culturally relevant pedagogy can transform mathematics education (Olawale, 2025). By asking, "How can I improve my practice?" I have documented a journey of critical self-reflection that aligns with Mezirow's Transformative Learning Theory. This process involved a fundamental shift in my ontological and axiological stance—from viewing mathematics as a static, instrumental body of knowledge to understanding it as a communicative, culturally-grounded practice. This personal transformation is a necessary precursor to broader change.

The study, therefore, calls for gradual curricular reform and teacher preparation programs that support inclusive, empowering, and authentic learning experiences. Such programs must be designed with Vygotsky's ZPD in mind, scaffolding teachers to navigate the challenging tran-

sition from traditional to transformative pedagogy. As Billett (2001) describes, transformative education involves connecting new knowledge to prior understanding, enabling holistic professional growth for educators—a process that resonates deeply with the transformative learning journey this study embodies. Thus, this study is a personal and professional inquiry that contributes to a "living theory" of culturally contextualized mathematics education in Nepal. As teachers, educators, and researchers, we aim to inspire others to adopt approaches that make mathematics more accessible, meaningful, and enduring for all learners by explicitly connecting pedagogy to the socio-cultural realities of the classroom and embracing the transformative potential of critical reflection.

## LIMITATIONS AND FUTURE RESEARCH

This inquiry offers valuable insights into culturally contextualized mathematics education. Primarily, its reliance on auto-ethnography and first-person narratives centres the subjective experiences of a single individual (Hem), which may constrain the broader applicability of its insights. As this method allows for introspection, it also introduces the risk of personal bias overshadowing empirical rigor. The use of arts-based ethnodrama is innovative but raises concerns about its replicability and methodological robustness. The study's focus on Nepali cultural and religious elements, such as Hindu epics and temple symbolism, further narrows its relevance to more secular or culturally diverse educational environments. Moreover, the critique of rote learning and the call for contextualized pedagogy are compelling.

Future research should pursue several key directions to build on these findings or insights and address the outlined limitations. Comparative studies across varied cultural, linguistic, and socio-economic contexts could help assess the broader applicability of ethno-mathematics principles. Empirical investigations into the use of arts-based methods, such as ethnodrama, in mathematics classrooms are also needed to evaluate their impact on student engagement, understanding, and critical thinking. Developing teacher training programs that support the integration of cultural and community knowledge into math instruction, while navigating curricular constraints, could further enhance pedagogical effectiveness. Aligning contextualized teaching approaches with standardized assessment systems would help ensure students are not disadvantaged in exam-driven environments. These efforts can strengthen the global theoretical and practical foundations of culturally responsive mathematics education.

## Data Availability Statement

The raw data supporting the conclusion of this article will be made available by the authors without undue reservation.

## Ethics Statement

The research committee at Nepal Open University, Lalitpur, Nepal, granted ethical approval for this research. The study was conducted in accordance with the local legislation and institutional requirements.

### Author Contributions

**HLD:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Validation, Visualization, Writing – original draft, Writing – review & editing. **ND:** Conceptualization, Data curation, Formal Analysis, Investigation, Methodology, Resources, Writing – original draft, Writing – review & editing. **IMS:** Conceptualization, Data curation, Methodology, Resources, Visualization, Writing – original draft, Writing – review & editing. **RM:** Conceptualization, Data curation, Formal Analysis, Writing – original draft, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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