Bridging Past and Present: The Pedagogical Value of the History of Mathematics

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Abstract:

This study explores how secondary-level mathematics teachers integrate the History of Mathematics (HoM) into their classroom teaching and the challenges they face in doing so. Using a qualitative descriptive approach, semi-structured interviews were conducted with six teachers trained in HoM to understand their strategies, experiences, and perceptions. Findings reveal that incorporating historical narratives enhances student engagement, deepens understanding, and shifts attitudes by presenting mathematics as a human and cultural endeavor rather than a set of fixed rules. Teachers reported that sharing stories of mathematical development makes lessons more meaningful and accessible. However, challenges such as limited resources, lack of training, and curriculum constraints hinder effective integration. The study highlights the need for targeted professional development and supportive materials to empower teachers. Integrating HoM holds potential to enrich mathematics education by connecting students to its cultural roots and fostering a more positive and thoughtful learning environment.

Keywords: History of Mathematics, Culture, Mathematics teaching, Pedagogy

Introduction

The root of the term mathematics is in the Greek word *mathemata*, which was used quite generally in early writings to indicate any subject of instruction or study to particular fields of knowledge (Burton, 2011). Previously, the Pythagoreans used mathematics to refer to both arithmetic and geometry, which were previously seen as separate subjects with no shared name. This might be why some believe mathematics began in classical Greece between 600 and 300 B.C. However, its roots go back much further three to four thousand years ago, ancient Egypt and Babylonia already had a substantial amount of mathematical knowledge. From the beginnings of

recorded history, the major disciplines within mathematics such as arithmetic arose out of the need to do calculations relating to taxation and commerce, algebra arose to understand the relationships among numbers, geometry arose to measure land, and analysis arose to predict astronomical events (Eves, 1983). Throughout the centuries, mathematics has been recognized as one of the central strands of human intellectual activity. It has its roots in everyday activities of human beings. For Chorlay, Clark and Tzanakis; (2022), mathematics is often seen as strict and impersonal, but it is actually a living subject shaped by human discoveries and cultural influences. It changes over time and connects with many fields. Using history in teaching can help students see its growth, impact, and contributions from different cultures. Thus, mathematics has been part of human life for over four thousand years. It is an important part of human culture, and it is useful, beautiful, and full of new ideas (Man-Keung, 2000).

Mathematics can be viewed as a continuous progression of abstractions or a widening of its scope. The earliest abstraction was likely that of numbers. Understanding that two apples and two oranges share a common property marked a breakthrough in human thinking. Beyond counting physical objects, prehistoric people learned to count abstract ideas like time (days, seasons, years) and naturally developed operations such as addition, subtraction, multiplication, and division. Recording numbers required writing or other systems, such as tallies or the knotted strings called quipu used by the Inca for storing data. Numeral systems were varied, with the earliest written numerals found in Egyptian Middle Kingdom texts like the Ahmes (Rhind) Papyrus. The Hindu civilization later introduced the modern decimal system, including the zero (Eves, 1983). Thus, the evolution of mathematics progressed from recognizing numbers and counting both objects and abstract quantities to developing operations.

Mathematics is something humans have created and developed for over four thousand years. It began as a way to meet the social and economic needs of ancient civilizations like the Babylonians, Egyptians, Indians, Chinese, Greeks, and Romans. In early times, people solved math problems through practical, hands-on methods, but later, they began using logical, step-by-step reasoning. Throughout history, mathematics has always been linked to the economic and social growth of societies. Today, our modern world depends heavily on technology, and its progress would be impossible without mathematics. Other sciences, such as physics, chemistry, and biology,

have also relied on mathematics to grow and advance. Because science helps us understand the world, mathematics is an essential part of human culture and scientific knowledge.

The History of Mathematics (HoM) offers a rich narrative of human curiosity, problem-solving, and cultural exchange, tracing the evolution of mathematical ideas from ancient civilizations to the modern era. Integrating this historical perspective into mathematics education not only contextualizes abstract concepts but also fosters deeper understanding, critical thinking, and cultural appreciation among learners. In the secondary classroom, the use of historical narratives, problem-solving methods from the past, and stories of mathematicians can make mathematics more relatable and meaningful. This study examines how secondary-level mathematics teachers, trained in the HoM, incorporate historical perspectives into their teaching, exploring both their strategies and the challenges they encounter in bridging the past with present-day mathematics learning.

Panasuk and Horton (2013) believe that mathematics should not be taught in isolation, separated from its history. They argue that when mathematics is taught without showing where it comes from or how it developed over time, it loses an important human connection. Ignoring its history hides the fact that mathematics is a human creation, shaped by real people, cultures, and problems of the past. Understanding this history is important for the future growth of modern mathematics, as it provides the foundation for scientific methods and offers insight into how people think and learn. Moreover, it can improve the teaching of mathematics and is an essential part of human culture.

Research Objectives

The objectives of this paper are intended to:

- **examine** how teachers integrate historical perspectives into mathematics lessons.
- **assess** the challenges teachers, face when incorporating the HoM into classroom practice.

Literature Review

Mathematics is the body of knowledge and information related with the concepts of quantity, structure, space, and change, and also the academic discipline that studies them (Michaelis, Grossman, & Scott 1967). It is the science of pattern found in numbers, space, science, computers, imaginary abstractions, or elsewhere. Through the use of abstraction and logical

reasoning, mathematics evolved from counting, calculation, measurement, and the systematic study of the shapes and motions of physical objects. The HoM is important also as a valuable contribution to the history of civilization. Human progress is closely identified with scientific thought. Mathematical and physical researches are a reliable record of intellectual progress (Kline, 1972). The HoM is one of the large windows through which the philosophic eye looks into past ages and traces the line of intellectual development (Cajori, 1909). Thus, the history of mathematics is the mirror of civilization.

The integration of HoM not only supports knowledge acquisition and problem-solving skills but also fosters cultural appreciation, moral development, and positive attitudes toward mathematics (Wang, Qi, & Wang, 2017). They present a **six-dimension categorization framework** for the educational values of integrating the history of mathematics into teaching and the framework comprising harmony of knowledge, beauty of ideas or methods, pleasure of inquiries, improvement of capabilities, charm of culture, *and* availability of moral education—aligns closely with curriculum objectives and captures both cognitive and affective outcomes. This model offers valuable theoretical guidance for teachers, curriculum designers, and researchers, enriching the field of history in mathematics education and providing a foundation for evaluating and improving instructional practices.

Teacher educators need to give enough historical, cultural, and mathematical background while also allowing space for the feeling of distance that helps genuine engagement (Guillemette & Radford, 2022). The classroom is seen as a place shaped by culture, where mathematics also has social and ethical values. If the encounter with the text is too structured, it can limit real dialogue. If it is not prepared enough, students may not understand the voices from the past. The authors note that such encounters are unpredictable and shaped by the active exchange between past and present voices.

The study of Seyda and Gulcin (2021) looked at what middle school mathematics teachers and university faculty think about using the HoM in teaching. Both groups agreed it is important and can make lessons more meaningful, help students understand how math developed, and give them a richer perspective. They also believed it can improve teachers' knowledge, job satisfaction, and teaching skills. However, both noted challenges, especially teachers' lack of knowledge about math history, time limits, overloaded curriculum, and exam-focused education. Teachers also

mentioned that some students find history boring or hard to connect with math. The study suggests improving teacher training, adding HoM to the curriculum and textbooks, and creating supportive resources to make its use in classrooms more effective.

Mathematics is often seen as a subject of strict logic, definitions, theorems, and proofs, giving it an impersonal and "cold" image. However, it is actually a living human activity with a long history, shaped by the ways people have explored, discovered, and applied ideas over time. Mathematical knowledge is not fixed; it changes with new discoveries and cultural influences. Integrating history into mathematics education can show students that mathematics has evolved, has interacted with other fields like science, art, and philosophy, has driven human progress, and has been enriched by contributions from many cultures (Chorlay, Clark & Tzanakis; 2022).

The reviewed studies collectively show that integrating the HoM into teaching has strong educational and cultural benefits. It can enhance students' conceptual understanding, problem-solving skills, appreciation of mathematics as a human endeavor, and even moral and cultural awareness. Research also highlights that historical perspectives can make lessons more engaging and meaningful, while fostering teachers' professional growth (Man-Keung, 2000; Seyda & Gulcin, 2021). Much of the literature provides theoretical models or teacher/faculty opinions, but fewer studies combine teacher interviews with direct classroom observations to capture real teaching practices and decision-making processes. In the specific context of Nepal, the integration of HoM into the mathematics curriculum, teacher preparation programs, and local cultural perspectives remains underexplored in the HoM education research. This gap creates an opportunity for the present study to provide context-specific, practice-oriented insights into both the integration strategies and the challenges faced by secondary mathematics teachers.

Method and Procedures

As my research objectives intended to examine **how teachers integrate historical perspectives into mathematics lessons,** I chose **qualitative research methodologies** because this approach allows for a deeper exploration of participants' lived experiences, beliefs, and teaching practices. A **qualitative descriptive approach** was particularly appropriate for this study as it aims to provide a rich, detailed account of real-life practices without imposing a rigid theoretical framework. This method allowed me to describe and interpret the actual strategies teachers employ, the reasons behind their choices, and the contextual factors influencing their decisions.

A semi-structured interview approach was used to explore teachers' perspectives on incorporating the HoM into mathematics teaching. Through **semi-structured interviews**, I could explore teachers' personal reflections, professional experiences, and pedagogical reasoning in their own words, enabling flexibility to probe emerging themes. The main interview questions were: *"How has the History of Mathematics course contributed to your teaching, and would you be willing to incorporate it into your lessons?"*, *"How can including the history of mathematics in your lessons affect students' understanding and interest in mathematics?"* and *What difficulties have you encountered when incorporating the HoM into your mathematics lesson?*" Follow-up sub-questions were asked based on participants' responses to gain deeper insights. Interviews were conducted with six randomly selected teacher candidates, each lasting approximately 15–20 minutes.

All conversations took place within the college/school setting. The data were analyzed through open coding to identify key ideas such as the benefits of HoM, integration challenges, student engagement, and resource needs. These codes were organized into broader categories using axial coding to reveal patterns across narratives. Triangulation was achieved by cross-checking themes with a second researcher, resolving discrepancies collaboratively. Selected participant quotes were used to illustrate themes, ensuring authentic representation of teacher candidates' experiences with integrating the HoM in their teaching.

Findings and Discussion

The teaching and learning of mathematics may be facilitated by studying the cultural significance of mathematics, and that historical context may enhance motivation and encourage interest in learning mathematics. The knowledge of how and when some problems and resolution methods are born not only contributes to a complete and unitary vision of the knowledge in general, but also to the assimilation of technical arguments and to the identification and overcome of some difficulties. The history of mathematics appears to present itself as a useful resource for understanding the processes of formation of mathematical thinking and for translating this kind of understanding into the design of classroom activities. The incorporation of historical development of the subject and the biographies of mathematician provides some insight into the development of positive attitudes towards the subject in one hand and on the other hand it can contribute to the revamp change in the conventional classroom teaching. Incorporation of history in the

mathematics classroom also helps to appreciate the usefulness of mathematics in real life situations. Thus, the use of history in lesson can improve students' perception about the value of mathematics to mankind and motivate them to learn mathematics.

Potential of Integration of HoM in Teaching Mathematics

The development of every subject has its own history. The history of the origin, gradual development of the phenomenon provides the detail information and create environment to think about the subject. Mathematics is one such phenomenon which has quite history. The present form of mathematical knowledge is not the exclusive product of single society and culture. It is of the cumulative form of the knowledge of the diverse culture and society. Every culture on earth has developed some mathematics. In some cases, this mathematics has spread from one culture to another. I asked a question: how can integrating the HoM in mathematics lessons affect students' understanding and interest in mathematics? to all my six teacher participants. Regarding this question, one of my research participants TP1 viewed that

> When I take a bit of time to explain how a mathematical idea developed students' faces light up. They realize mathematics didn't just appear in a textbook one day. It's the result of real-life application, people thinking, and experimenting. That changes their whole attitude, they take mathematics is a human endeavor instead of seeing mathematics as this fixed set of rules they have to memorize.

This narrative shows how explaining the history of mathematics helps students understand that math is created through human thinking and real-life problems. This supports the study's objective to explore how incorporating the history of mathematics in lessons can improve students' understanding and change their attitude toward math from memorizing rules to appreciating it as a human activity. The National Council of Teachers of Mathematics (NCTM, 2000), viewed that mathematics is one of the greatest cultural and intellectual achievements of humankind, and citizens should develop an appreciation and understanding of that achievement and contribution on the different fields. Another research participant TP2 speaks:

> From my experience, when I include stories about how mathematical concepts were discovered, students seem more curious and engaged. It helps them see math not just as formulas but as a human endeavor, which makes the subject feel more meaningful.

This narrative aligns with existing literature that highlights the positive impact of integrating the history of mathematics in teaching. Research shows that presenting mathematical concepts through their historical development increases student engagement and curiosity (Seyda & Gulcin, 2021). In response to my research question, another research participant, TP5, said:

> When I bring historical examples into lessons, students become more engaged and ask thoughtful questions. They like hearing about famous mathematicians and the challenges they faced. This narrative approach makes mathematics less intimidating and more accessible, boosting both their interest and confidence.

From the narrative of TP 5, it is come to know that students find the subject more meaningful and relevant when framing mathematics as a human endeavor rather than just abstract formulas, which supports deeper understanding and motivation. Thus, the teacher's experience reflects well-documented benefits of using historical narratives in mathematics education. Furthermore, Swetz (1994) suggested that "the history of mathematics supplies human roots to the subject. It associates mathematics with people and their needs. It humanizes the subject and, in doing so, removes some of its mystique" (p.1). Many researchers have argued that the use of the history in mathematics classroom can lead to develop positive attitude and better achievement in mathematics. With this regards, Marshall and Rich (2000) mentioned that the history of mathematics allows students and teachers to think and talk about mathematics in meaningful ways. It demythologizes mathematics by showing that it is the creation of human beings. It deepens the values and broadens the knowledge that students construct in mathematics classroom. The teacher of mathematics generally engages students through the full of the problem-solving situations in the class room. That's why the students' considered mathematics is clumsy and desert subject without any livelihood context. The incorporation of history of mathematics into the classroom choosing relevant historical subjects becomes interesting and effective. The mathematics teachers can treat mathematics as it is conceived today as the exclusive products of the different civilizations and culture.

The findings show that integrating the history of mathematics into lessons helps students view mathematics as a human creation rather than just a set of fixed rules. Teachers reported that historical stories and examples increased students' curiosity, engagement, and confidence, while also making the subject feel more meaningful and less intimidating. Presenting concepts through

their historical development connected mathematics to real-life problems, supporting deeper understanding. These experiences align with research that highlights the history of mathematics as a way to humanize the subject, foster positive attitudes, and recognize it as a cultural and intellectual achievement of diverse societies.

Challenges Teachers Face in Incorporating HoM in Classroom

Over the year mathematicians, educators and historians have wondered whether mathematics learning and teaching might profit from integrating elements of history of mathematics. Many researchers have suggested that the use of history of mathematics in education is related to positive students learning outcomes and supported its inclusion in national curricula (Fauvel, 1991). However, in practice, history of mathematics is rarely used in schools, as teachers cannot commit the time to prepare the relevant teaching materials. It is clear that mathematics education does not succeed to reach its aims for all students, and that it is therefore worthwhile to investigate whether history can help to improve the situation. Panasuk and Hortaon (2013) observed in their study that the majority of teachers responded agreed to the relevance of the HoM to mathematics learning, and believed that HoM has its values and place in the school curriculum.

To address the second objective, "To assess the challenges teachers face when incorporating the HoM into classroom practice," I asked the question: **"What difficulties have you encountered when incorporating the HoM into your mathematics lessons?"** In response to this question, one of my teacher participants, TP4, stated that:

> I find it hard to find good materials that explain the history clearly and simply. The textbooks don’t have include historical evolution of the contents, so I have to spend extra time looking for stories and examples.

From the narrative of TP4, it comes to know that teachers are struggling to find clear and simple materials on the HoM. Many researchers (Fauvel 1991; Tzanakis & Arcavi, 2000) have noted that mainstream mathematics textbooks often focus primarily on procedures and concepts, offering little to no historical context or narratives. Furthermore, Panasuk and Horton (2013) expressed that many teachers avoid including the HoM in their teaching because they feel they lack expertise, often due to limited exposure to HoM during their own education. Providing at least one dedicated HoM course in teacher preparation could build their content knowledge and confidence, enabling them to present mathematics as an interconnected story that engages and

enriches student learning. This lack of integrated historical content forces teachers to seek supplementary resources, which can be time-consuming and difficult to locate, especially those that are age-appropriate and culturally relevant (Clark & Lovric, 2009). The absence of well-structured materials limits the effective incorporation of history into teaching and can discourage teachers from using historical perspectives regularly (Tzanakis & Arcavi, 2000). Another research participant TP6 advocated that

> Sometimes, I feel I don't have enough knowledge about the history myself to teach it confidently. Without proper training, it's difficult to connect historical ideas with the math topics we cover.

Many secondary-level teachers express a lack of sufficient content knowledge about the HoM, which affects their confidence in teaching historical aspects effectively. Without proper training or coursework on HoM during their teacher education, they often feel unprepared to accurately explain the development of mathematical ideas or to integrate historical narratives meaningfully into lessons. This gap in knowledge makes it difficult for teachers to connect historical contexts with the specific math topics they cover, such as algebra, geometry, or calculus, resulting in missed opportunities to enrich students' understanding. Research indicates that when teachers lack a deep understanding of both mathematics content and its historical background, they may present concepts as isolated facts rather than as part of a connected, evolving story (Furinghetti & Radford, 2002). This fragmentation can reduce student engagement and limit their appreciation of mathematics as a dynamic human endeavor. Therefore, enhancing teachers' content knowledge about HoM through targeted professional development is crucial to help them bridge historical insights with curriculum topics effectively. This challenge emphasizes the need for curriculum developers and educational publishers to include rich historical content in mathematics textbooks, as well as the importance of providing teachers with accessible, quality resources and professional development opportunities to support the integration of history in mathematics education.

> Time is a big problem. Our syllabus is very full, and it's challenging to add history without losing time for practicing mathematics problems and preparing for exams."

Learners will acquire a notion of processes and progress and learn about social and cultural influences. Just all human cultures generate language, religious beliefs, rituals, food-producing

techniques, etc., so it seems do all human cultures generate mathematics. Moreover, just as each cultural group generates its own language, religion belief, etc., so it seems that each cultural group is capable of generating its own mathematics (Bishop, 1998). Hence students can experience the subject as a human activity, discovered, invented, changed and extended under the influence of people over time. Instead of seeing mathematics as a ready-made product, they can see that mathematics is a continuously changing and growing body of knowledge to which they can contribute themselves (Clanche & Sarrazy, 2006).

History also highlights the connections between different mathematical topics and the role of mathematics in various disciplines, helping to situate mathematics within a broader context and enhance students' understanding. Studying the history of mathematics offers insights into the nature of mathematics itself. When teachers' own understanding and perspective of mathematics evolve, it influences their teaching methods and, in turn, shapes how students perceive the subject. Knowledge about the historical development of a mathematical concept can make it easier for teachers to explain ideas or provide illustrative examples. For example, historical heuristic methods can be contrasted with modern, formal approaches to enrich learning.

In addition, it is believed that historical knowledge gives the teacher more insight in different stages of learning and typical learning difficulties. On a more personal level, history also helps to sustain the teacher's interest in mathematics. It provides teachers with a plenty of interesting mathematical problems, sources and methods which can be used either implicitly or explicitly. Most of the terms, concepts, symbols, ideas and conventions of mathematics can be properly understood only by reference to their historical background. There are number of mathematical topics which can be introduced with the help of history of mathematics. Thus, teachers should not only acquire knowledge about different methods of teaching but also, they should have a clear knowledge and idea about the history of mathematics for the successful teaching of mathematics.

The findings reveal that while teachers recognize the value of integrating the history of mathematics (HoM) to make lessons more engaging, meaningful, and connected to human culture, they face significant challenges in doing so. These include a lack of accessible and age-appropriate teaching materials, insufficient content knowledge about HoM due to limited training, and time constraints within a packed curriculum. Teachers reported that without proper resources and

professional development, it is difficult to confidently link historical narratives to specific mathematical topics. Despite these challenges, they acknowledged that incorporating HoM can deepen students' understanding, foster curiosity, and present mathematics as a dynamic, evolving human endeavor rather than a static set of rules.

Concluding Remarks

The integration of the HoM into teaching offers significant pedagogical benefits, transforming mathematics from a set of abstract rules into a meaningful human endeavor. Evidence from both literature and teacher narratives shows that historical perspectives can increase student engagement, curiosity, and appreciation of mathematics by revealing its cultural roots, human struggles, and real-world applications. Students respond positively when they see mathematics as a product of human thought and problem-solving across civilizations, rather than as an isolated, static discipline. Teachers also find that historical narratives can make concepts easier to explain and connect with broader contexts. However, despite these benefits, challenges remain. Teachers often lack sufficient knowledge of mathematical history, feel unprepared to teach it confidently, and struggle to find accessible, age-appropriate materials. Overloaded curricula and exam-focused systems further limit the time available for incorporating history into lessons. These constraints mean that, while the value of HoM is widely acknowledged, its classroom use remains limited. To address these gaps, there is a clear need for improved teacher preparation, professional development, and resource creation that embeds historical content within curricula. Supporting teachers with both the knowledge and tools to integrate HoM effectively can not only enhance students' understanding and attitudes toward mathematics but also contribute to a richer, more connected vision of the subject as a dynamic cultural achievement. Ultimately, integrating HoM offers a pathway to humanize mathematics, deepen conceptual understanding, and inspire students to see themselves as contributors to an ongoing intellectual tradition.

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