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A Review on Teachers and Students Engagement in Mathematics Learning: A Critical Reflection on Nepalese Context

Dal Bahadur Thapa
Teaching Assiatant, Department of Mathematics
Dhawalagiri Multiple Campus, Baglung,
Email: thapadal32@gmail.com

Abstract

This article focuses on the engagement of students and teachers in mathematics learning within Nepalese classroom. Mathematical interaction is considered a significant concern in Nepal, particularly due to the multicultural and multilingual nature of the classrooms. Nepalese students come from diverse cultural and linguistic background, posing challenges in implementing constructive approaches to teaching mathematics. The teacher-student interaction is regarded from a cognitive perspective, recognizing both parties as mutually authoritative subjects actively interpreting and anticipating within the classroom. The primary objective of this article is to investigate the dynamics and effective use of constructivist principles in mathematics classrooms in Nepal. Through qualitative research methods, the study has the potential to offer valuable insights into the challenges and interactions between teachers and students, especially in multicultural and multilingual settings. By exploring these dynamics and analyzing the successful application of constructivist principles, this research can have a positive impact on mathematics education and instructional strategies in Nepalese classrooms, ultimately leading to improved student engagement and learning outcomes.

Keywords: constructivism, environment, linguistic, mathematical interactions, multicultural

Introduction

Classrooms in Nepal commonly exhibit multicultural and multilingual characteristics as students from diverse cultural and linguistic backgrounds attend school. This situation aligns with the sentiments expressed by (Gates et al., 2006) "In a lot of parts of the world, mathematics teachers are facing the face of teaching in multi-ethnic and multi-lingual classrooms holding - immigrant, indigenous, migrant, and person in exile children, and if research is to be helpful it has to address and help us appreciate such challenges" (p. 391). Nepalese context, the presence of multiple languages and ethnic clusters creates its own set of challenges within the classroom, which are further compounded by the issues related to internal displacement and migration resulting from the country's ten-year conflict and subsequent political instability. These challenges are impacting the teaching and learning mathematics, as the expert-designed mathematics curriculum implemented by government, does not align with the cultural context and values of Nepal. We think that it is Western mathematics that we are teaching and learning without allowing for the needs of students, diversity and values of our society needs of students, diversity and values of our society (Panthi & Belbase, 2017). Mathematics teachers' various challenges in facilitating effective student interaction, often referred to as "math-talk". The main is the difficulty of trying to teach mathematics in ways they did not skill as students (Bruce, 2007).

In addition, teachers may feel uneasy about their level of mathematical content knowledge and lack continuous professional development opportunities, which can hinder their adoption of math-talk strategies. Furthermore, the compound compromise of math talk in the classroom requires facilitation skills and sensitive attention to classroom dynamics. facilitation skills and sensitive attention to classroom dynamics. The teacher must model math talk so that students know the rules of interaction in the math classroom, support students to justify their solutions and construct on one another's ideas and final step to the side as students take growing responsibility for sustaining and enriching interactions. Time constraints also pose a challenge, as teachers often perceive the demands of the curriculum as inhibiting the implementation of math talk. However, the research indicates that despite these challenges,

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teachers should have devised some mainly effective strategies for facilitating math talk in their classrooms.

Within the mathematics literature, the acquisition of mathematical knowledge is often described as a social Endeavour. In this model, the math classroom functions as a community that promotes active engagement in thinking, talking, approving, and disagreeing. The teacher presents students with influential math problems to solve collaboratively, with an emphasis on validating and explaining their solutions. The primary objective is to extend one's thoughts as well as that of others. Influential problems are problems that allow for a range of solutions, or a variety of problem-solving strategies. Math problems are powerful when they obtain students beyond the singular goal of calculative mastery into more complex math thinking. The mathematical understanding increases further when students share their logic. When the traditional mathematics teaching model, will be focused on basic computational procedures with little facilitation of student discourse, continue to be the common instructional approach.

Mathematics education encompasses a variety of hypotheses and philosophies. Two widely discussed philosophies and theories in the literature of mathematics education are radical constructivism and social constructivism (Belbase, 2014). In Nepal, the prevailing views of mathematics such mathematics as a foreign subject, a collection of symbols, and a meaningless subject. These perspectives have influenced the worldview of many individuals involved in mathematics education in Nepal. The choice of these two leading theories is based on the contemporary debate on whether the interaction between teachers and students in mathematics classrooms in the context of Nepal, is an individual or social phenomenon and the nature of the Nepalese community and cultural value system. Teacher-student engagement will be observed from a cognitive point of view in the sense that teachers and students are mutually influencing subjects in an interaction process which they will interpret and anticipate while acting within a classroom (Interactions et al., 2014).

Radical Constructivism

Radical constructivism is a learning theory that emphasizes the learner's active construction of knowledge and understanding. According to this viewpoint, students should be concerned with critical reflection on learning mathematics. The teaching and learning processes undertake through assimilation, accommodation, adaptation, and reconstruction (Glasersfeld, 1996). The students are taught mathematics through active construction of the meaning of concepts they study through individual re-organization, re-presentation, rebuilding and social negotiation with peers, elders, and teachers (Belbase, 2016). Though there are a few major components of radical constructivism in teaching and learning mathematics that happen from mathematically weak students, application of teacher-coincide pedagogy, untrained teachers, the existing curricula, our diverse social and cultural context and general being short of practical resources for classroom practice.

The theory of radical constructivism centres on the cognitive process of learning and teaching mathematics which is completely a mental process. For the achievement of teaching and learning mathematics in the classroom, students are accomplished to go away through individual and collective mental processes to create a sense of concepts they learn and build upon their further thoughts. However, it is not easy in our classroom teaching and learning due to large class sizes and limited or no classroom resources. We believe that mental actions and processes are mediated through what students and teachers do in the classroom. The theory of radical constructivism believes that students construct their concepts of what they learn through active cognitive and adaptive processes. Students may give their indication and argument about the content, process, and product in teaching and learning and they build the knowledge of mathematics (Panthi & Belbase, 2017). However, these phenomena are related to social and cultural adaptation of knowledge and meaning. The role of language and interactions amongst peers or community of perform has not been well imagined in this paradigm and the extreme focus on the individual process of knowing and constructing knowledge has shaped a ground for dilemma (Panthi & Belbase, 2017) While adopting radical constructivism, teachers attempt to give them adequate hold in learning mathematics. Some of these issues are also connected with philosophy and the theory of social constructivism.

Social Constructivism

According to Vygotsky (1978), social constructivism in mathematics learning emphasizes collaborative interaction among students to actively construct their understanding of mathematical concepts. According to this theory, mathematics knowledge is built through social interaction. Arbitration plays a significant role in learning mathematics. It focuses that children learning from others or society through active interactions and sharing in activities in groups or with peers. Scaffolding and direction are necessary for learners. Vygotsky explained the Zone of Proximal Development (ZPD) as the distance between a child's ability in independent problem-solving and the probable ability to problem-solve with guidance (Burton et al., 1999). Though, there are concerns

linked to linguistic factors, cultural factors, traditional curriculum, conventional assessment system, inappropriate classroom size, passive learners, untrained teachers, use of banking pedagogy, and disadvantaged learners while adopting social constructivism in teaching and learning mathematics. It is an arguable issue because the social domain contains linguistic factors, interpersonal interactions such as peer interaction, and the role of instruction of the teacher. The term 'social constructivism' created in sociology and philosophy comes from two sources (Izmirli, 2014). The first is the social constructivist sociology of mathematics, in which students narrates it to mathematics education. The second is the social constructivist theory of learning mathematics. It is applied in different contexts, and it impacts the development of individuals in some formative ways, with the individuals building meanings in reply to experiences in social settings. For us, social constructivism centers on questions: How to explanation for the nature of mathematical knowledge as socially constructed? How to give a social constructivist account of the individual's learning and construction of mathematics? We feel that an important issue concerned in the second question is that of the centrality of language to knowledge and thought. It is a major issue in the community of mathematics education.

Research Questions

1. How can constructivist principles be effectively implemented to enhance mathematics learning in Nepal?
2. What are the challenges faced by teachers and students in engaging in mathematics learning in Nepalese classrooms?

Review of Literature

The cognitive perspective recognizes teacher-student interaction as a mutual and authoritative process, where both teachers and students interpret and anticipate actions within the classroom. To shed light on this interpretative process, certain factors are considered that elucidate the mechanisms within the instructional situation, with teacher behaviour as the "input" and student's performance as the "output". Which deals with those features that typically arise in mathematics classrooms (Interactions et al., 2014). Some problems concerning the weight of the structure of mathematics on teacher-student interaction are outlined. The study of teaching and learning within mathematics classrooms can be set apart through a variety of lenses. Large-scale comparative studies give information on the effectiveness of curricular materials or specific teaching methods. Small-scale studies give a more detailed analysis of interactions over time and document the learning trajectories of both students and teachers. Case study research designs specifically incarcerate the nuances of "in the moment" experiences of those being studied. This study exploited what Stake (1994) described (Nicolazzo, 2017) Specifically, the goal was to explain the particulars of how students build intelligence in complex content, at the moment, of essential mathematics deliberations. While the nature of the mathematics content was vastly different, similar elements such as problem-posing and orchestrating dialogue were evidenced in both classrooms.

The relations between cultural and domain knowledge in mathematics, explore multiple ways that culture has been viewed by scholars as having a bearing on math teaching and learning. A very visible feature in Mathematical Modeling is the request for the students to work in groups(Barbosa, n.d.). This does not, however, indicate that the teacher is not present to follow the students' work. As stated by Ikeda and Stephens (2001), the teacher wants to stimulate the students' questioning and indication during the mathematical modelling process. A study conducted shows a case in which a student had strong contact, through frequent meetings with the teacher, which resulted in a modelling project that conventional a good evaluation. Thus, the intention is to highlight here the moments in which students and teachers come together to discuss modelling activities.

Among the six principles of school mathematics, the National Council of Teachers of Mathematics (NCTM) states equity as the first principle (The National Council of Teachers of Mathematics, 2000). In its equity principle, (The National Council of Teachers of Mathematics, 2000)tells, "All students, despite their personal characteristics, backgrounds, or physical challenges, can learn mathematics when they have the right to use high-quality mathematics instruction" (p. 2). Further, it shapes, "Brilliance in mathematics education requires equity, high outlooks and strong support for all students" (NCTM, 2000, p. 10). In this regard, NCTM counsels for the arrangement of huge prospects, valuable opportunities, and accommodations for differences to arrive at equity in mathematics classrooms (Panthi et al., 2018).

Discussion

The main objective of this study is to analyze the level of engagement among mathematics teachers and students in the math classroom. However, several challenges need to be addressed to generate appropriate research questions and involve all mathematics teachers and students in providing meaningful responses. One major concern is ensuring that the research questions are focused on producing valuable outcomes. Additionally, adequate preparations must be made to tackle the logistical and practical issues associated with conducting the study

effectively. The study of teaching and learning within mathematics classrooms can be distinguished through a variety of lenses. Big-scale relative studies provide information on the effectiveness of curricular materials or specific teaching methods, the study of mathematics instruction, learning, and classroom interactions capture the spirit of teaching for understanding in secondary classrooms (Dyer & Sherin, 2016). Responsive teaching through problem posing (RTPP), is a recurring model of instruction in which a problem is at first posed without provided that instructions on which strategies students be hypothetical to use to solve problems. The teacher initially decides who might share and students are positioned as experts to critique the reasoning of their peers. This series involves teachers' accomplishment of mathematically, culturally and personally pertinent problems, positioning of students as "specialists of mathematics", and orchestrating students' sharing of ideas. Teachers adapting their curriculum materials based on the cultural and age-specific interests of their students is a problem. They enact the problems using open-ended approaches such as, "solve this problem in any way that makes sense to you", and series the sharing of strategies.

The Department of Education of Nepal (DOE) (2012), has cleared inclusive education as a liberal education system that believes in child-centred pedagogy and respects multicultural and multilingual orientations in a non-discriminatory environment, so interacting and addressing these concerns is another problem. An inclusive mathematics classroom aims to give equal opportunities to the learners based on an equity and equality approach with respecting their backgrounds. The teachers come across several challenges in mathematics classrooms so they must have to compete and teach learners according to their needs and expectation. It seems to consider the situation of mathematics classroom practice (Acharya, 2020). In this context, what are the challenges that the teachers are explicating in inclusive classroom practices? And in what ways do they manage the confronts? To address these queries, research can investigate the specific challenges faced by teachers in implementing inclusive practices in mathematics classrooms and explore the strategies and approaches they employ to manage these challenges effectively. This can provide valuable insights into best practices and inform the development of support systems and professional development programs for teachers in inclusive mathematics education.

Although constructivism has appeared as one of the greatest influences on the practice of education, our mathematics teachers have not hugged constructivist-based pedagogy in the Nepalese context. We are familiar with quick fixes and shopping malls moving toward school improvement (King, 1998) without considering the actual process of learning mathematics. According to the student's cognitive, affective and developmental stage, radical constructivist teachers should go behind the various teaching techniques centring more on individual and group presentations, discussions, tests, debates and student choices, and application of mathematical models for resolving the problems. We are distant beyond giving the subject matters to students' interest and context and sharing ideas in the classroom, in Mathematics actively contributing to the construction of meaning while learning mathematics (Glasersfeld, 1996). However, the poor language background of the students, customary curriculum with content focus, passive students, diversity of ethnic groups, traditional teaching method (focus on rote memorization), and assessment without focus on construction, our diverse socio-cultural context, and lack of search- based teaching and learning practices are some of the major issues for applying radical constructivism in Nepalese context.

Effortlessly, the difference between the radical constructivist theories(Piagets individualistic theories) and socially based theories (Vygotskian theories) of learning mathematics is the main difference between the social and radical constructivist approaches. Mathematics knowledge is both individual and social and it is the human production. Vygotsky's sociocultural theory shifted from Preprints (Taylor & Luitel, 2019). Teaching and Learning Issues in Mathematics individual to collective but it is a series of individual to a social and social to an individual. Individual knowledge construction means a person who generates schemes and operates these schemes from the community of learners. The community of learners reviews it. Students reformulate this knowledge. Finally, students make a consensus from society and socially negotiate and make new mathematical knowledge. The concerns from the theory of social constructivism in our context are our traditional curriculum, unconventional assessment system, and classroom size. The assessment system accentuates rote learning and getting good grades and marks in exams. The examination does not determine students' real creativity and meaningful understanding of the subject matter. It does not provide value to the students' lived experiences. Our classroom sizes are not suitable for teaching and learning in social and interactive settings, and our teachers are not able to do mathematical interactions with students in the classroom. It owing to the large class size or general not has of knowledge of the importance of group interactions or lack of motivation to do it. Therefore, inactive learners or rote learners or poor teachers are one of the issues of social constructivism. In our background, it's hard to construct knowledge socially because of inactive learners or rote learners and poor

teachers. Mathematically poor students cannot reproduce critically, and pedagogically poor teachers cannot reflect students' shared experiences on mathematics. Our teachers are following the banking pedagogy with the linear fashion of efforts and outcomes which is one of the issues. It is also pointed out that teachers tend to use a banking pedagogy in which they seal students' minds, as containers, with the knowledge that someone has strong-minded they need to know (Tutak et al., n.d.).

The views of mathematics such as mathematics as a foreign subject, mathematics as a collection of symbols, mathematics as a meaningless subject, mathematics as a body of pure knowledge, and mathematics as objective knowledge (Luitel, 2009) have dominated the worldview of most of the math teachers and curriculum experts in Nepal. Hence, the subsequent action of teaching and learning and curricular practices in mathematics have been severely affected by such worldviews.

Despite Nepal's commitment to providing quality education in general and mathematics education by ensuring equity and access, there are so many issues of teaching and learning mathematics in the Nepalese context. Some of these issues are related to theories, and others are practical. These issues are related to classroom management, ethnicity, lack of trained teachers, inequity, lack of teaching aids and materials, lack of textbooks, lack of time for students, lack of clear objectives, gender issues, and issues of mathematical contents and pedagogy. Most of the schools do not have proper management of the classrooms. They have an inappropriate size of classes, no inclusive seating arrangement, and there is also a lack of technology for learning and teaching mathematics. There is a misuse of technological tools even if it is available. Also, we have classroom issues related to internal refugees and migrants due to the ten-year conflict in the country and post-conflict political instability. These issues are creating challenges for us in teaching and learning mathematics. The mathematics curricula designed by experts and implemented by the government for all grade levels do not fit our culture. it is not in sequential order at the school level and university level.

Despite the numerous challenges, it is crucial to prioritize and promote mathematical engagement in Nepalese classrooms. To foster mathematical engagement, teachers need access to appropriate teaching aids, manipulatives, and technology. However, resource constraints in Nepal can restrict the implementation of theories and interactive learning processes, which in turn can impact students' understanding and enthusiasm for mathematics in the Nepalese classroom.

Conclusion

In classrooms worldwide, students engage with mathematics knowledge daily. With the advancement in international communication and access, we can now observe efforts to promote students' learning in various cultures, considering local contexts that may lead to similarities or differences in approaches. One common goal among diverse global educational communities is to address the unique needs of an increasingly diverse student population. The understanding of mathematics teaching and learning has evolved from a purely cognitive process to one that recognizes the social aspects involved. It is crucial to develop a new framework to conceptualize mathematics teaching and learning to effectively support teachers and students. In this context, constructivist theories hold relevance for implementation in Nepalese classrooms.

In Nepal, the transition from traditional to constructivist approaches for teaching and learning mathematics is still underway, from a theoretical standpoint. Apart from radical and social constructivism, the issues related to teaching and learning mathematics in Nepal can also be examined through socio-cultural theories and critical theory. However, these more contemporary perspectives, such as postmodern theories, are not extensively discussed in the paper as they are not widely understood by teachers and policymakers. The paper briefly touches upon the theoretical aspects of radical and social constructivism, acknowledging that it is an incomplete representation since other theories are not included. Additionally, it is important to note that the challenges faced in the classroom regarding the teaching and learning of mathematics in Nepal extend beyond theoretical issues. Social, cultural, political, and technological factors also play a significant role and can impact the effective teaching and learning of mathematics in the Nepalese context.

Declarations

Ethics Approval and Consent to Participate

I declare that this research/review was conducted ethically.

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