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Editorial

Engaged Reading: A Pathway to Transformative Mathematics Learning

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Abstract

Conventional mathematics teaching-learning activity seems unable to foster creative, critical and reflective thinking in learners because it incorporates transmissionist pedagogy. A piecemeal, linear and reductionist approach prevents holistic learning that results in the mindless replica of mathematical knowledge, facts, skills and algorithms. It has socialized the learners into non-questioning roles, helped create and maintain passive identities, germinated feeling of inferiority, and lessened self-confidence and power to control their actions. It also conceals social, cultural, historical, political, affective and spiritual dimensions of mathematics education and its interconnection to real-world problems and develops literacy for 'stupidification' so that learners remain unconscious and unaware of unjust practices, power dynamics and hegemonic ideology. In this context, this editorial explores how to unearth the aforementioned components that restrict the mathematics education within the grips of dominate power structure, hegemonic ideology and pouring pedagogy and aims to envision an alternative empowering and transformative pedagogy. I realize that engaged reading is one of the most significant contributors that liberates mathematics from the 'one-size-fits-all' pedagogy and helps develop the learners' agency so that they can become change agents. Engaged reading incorporates cognitive, affective, academic, and social aspects of learning and illustrates the political (power structure), ideological, cultural and historical embeddedness. Furthermore, this paper illuminates three interconnected roles: - engaged reading as/for critical reflective practices, engaged reading as/for agentic development and engaged reading as/for transformative learning. Finally, I briefly present the overview of the issue.

Keywords: *Agentic development; Critical-reflective practice; Engaged reading; Transformative learning*

Introduction

Mathematics teaching-learning activity is one of the most debatable issues at the school and university levels. From the very beginning of the formal and so-called modern mathematics education practices that had started after the establishment of Durbar School in 1853, mathematics teaching-learning activities have become abstruse and dislocated from the socio-cultural and real-world problems (Lamichhane & Luitel, 2022). Mathematics practitioners were indoctrinated by an absolutist view of mathematics which celebrates the concept of mathematics as a pure body of knowledge (Luitel, 2013), unconcerned with the socio-cultural, historical, and political landscape of the society and nation. It further enhances the notion of universalization which helps flourish a ground for geminating the 'taken for granted assumptions' as mathematical knowledge and 'one-size-fits-all' pedagogical approach (Freire, 1972).

The absolutist view of so-called modern mathematics supports embracing the linear, reductionist and piecemeal approach in mathematics teaching-learning activities that focuses on reproducing patterns, procedures, formulae, and theorems without due consideration of conceptual, relational and cultural understanding (Lamichhane, 2021). It

gradually erodes creative and critical thinking and diminishes the questioning power of the learners, thereby lessening their self-confidence and becoming intellectually dependent on which mathematical othering takes palace. When mathematical othering is emerging or has already occurred, then mathematics is not a part of students, or students are not a part of mathematics (Abtahi et al., 2020). As a result, students quit thinking, reflecting, and engaging in mathematics. They become doers without having critical looks. In the words of John Dewey (2001), when 'learning by doing and reflection' turns into 'learning by doing without reflection', it becomes the meaningless replication of algorithms that orient learners to become passive recipients and muted followers.

When students become passive recipients, they do not see the connection between the classroom mathematics they engage in and the mathematics they experience out-of-classroom. Then they start memorizing the rules and procedures with an emphasis on storing mathematical knowledge and concepts aiming for reciting or reproducing when necessary. The culture of memorizing, speed recovery, and reproduction of mathematical knowledge, facts and concepts etc., impinges on the culture and history of mathematics education in Nepal and still plays a dominant role (Lamichhane, 2021). It indicates that mathematics educators and researchers are unable to remove the hegemonic grip of this narrow form of mathematics education from the hearts and minds of the practitioners, particularly those who control the educational institutions and always argue in favour of the instrumental and reproductive culture of so-called 'world standard' at the expense of socio-cultural, historical, ethnic, and linguistic diversities (Luitel & Taylor, 2010). It propels me, and I start to contemplate this issue by critically self-reflecting on my experiences.

Self-experiences of practitioners are not only an individual entity gained through cognitive/intuitive activities but also socio-cultural, historical and dialogical endeavors that help to illuminate the mathematics culture within which the learners are grown up, and learning takes place. That is, we can explore the mathematics culture within individuals and the roles of an individual within a culture. Why do our mathematics education practices fail to explore such dialectical relations among different phenomena existing within immediate culture and environment? Why do people in power who have access to and control of mathematics education not consider these issues seriously? Whose interests are being served by current mathematics education practices? Who is responsible? These are some of the propelling questions that lead me to engage in this issue.

From the very beginning of formal schooling to the end of my Master's degree in mathematics education (M.Ed.), I rarely got an opportunity to engage in alternative discourse to solve mathematical problems. The classroom environment seemed fearful. Teachers and students were always hurrying to complete the predesigned curriculum within the stipulated time. One-way communication took place. Teachers focused on solving/proving undue bookish questions/theorems and urged students to repeat the same. They always suggested solving questions that had been asked in the past final examinations to secure good marks. It is not an exaggeration to say that almost all teaching-learning activities focused on preparing for the upcoming final test. I do not want to claim that teachers lacked awareness or consciousness regarding alternative views of mathematics, curriculum, pedagogy and assessment. Still, I argue that students were restricted from engaging in creative, critical, imaginative and artistic works in the name of providing so-called 'world standard' mathematics. But there is always doubt as to why teachers have not opened discourse on alternative views of mathematics, curriculum, pedagogies and assessments. More precisely, I was unaware or prevented from being aware of alternative mathematics discourses and the

availability of ample literature on mathematics that could awaken me even though I was a good student and obtained the first position in my batch from school to university levels. In this regard, my argument is why our mathematics education could not create a space in which the learners get an opportunity to deeply engage in the learning process at their own pace, time and convenience so that they could explore the multidimensional connectivity and interdependence of mathematics with other natural and social sciences and its effects on human society and vice versa. It signifies that there is a lack of a culture of engaged reading in mathematics education that prevents imaginative thinking, creativity, and critical engagement, which has a severe effect not only on mathematics achievement but also on learners' cognitive, affective, and social development (Crick, 2012; Ivey & Johnston, 2015; Reeve, 2013).

Conceptualizing Engaged Learning

Student's engagement in learning is a fundamental construct in education which was initially conceptualized during the 1980s as a way to understand the forces behind the students' alienation, dropping out, anxiety, dislike and boredom and intended to reduce these forces to improve students' academic achievement (Finn & Zimmer, 2012). It orients towards understanding and mastering knowledge, concepts and skills that promote students' educational outcomes. The general indicator of students' engagement includes attending school and class regularly, following teachers' instructions, timely completing assignments, holding positive attitudes towards particular discipline, school and teacher, being eager to learn, and developing self-confidence in problem-solving (Newmann et al., 1992). The level of engagement was measured in terms of students' achievement in different disciplines. Students who do not participate actively in class, have low scores in school disciplines, have no cognitive involvement, lack of sense of belongingness and reveal inappropriate or counterproductive behaviours are labelled as disengaged learners. Engagement and disengagement in learning has been narrowly conceived within individual levels and oriented to measure the mastery of the intended subject matters. By synthesizing the concept of student engagement, Finn and Zimmer (2012) summarized it into four categories: academic, social, cognitive and affective.

Academic engagement describes observable behaviour explicitly related to the routine learning process. It consists of completing assignments, attentiveness in classroom activities, engaging in classroom tasks, participating in extracurricular activities, and self-reporting the learning status.

Social engagement refers to those activities in which students must follow implicit or explicit norms and rules of the classroom and society. It aims to enhance the extended observable behaviour of students in which they will discriminate social and antisocial behaviour, speak following socio-cultural obligations and maintain the socio-cultural positionality or hierarchy.

Cognitive engagement illuminates the process of cognitive strategies, expenditure of thoughtful energy to comprehend complex ideas or concepts, ability to solve problems and demonstrate the power of logical reasonings and arguments. To enhance students' cognitive engagement in the learning process, the teachers could create a classroom environment in which they can think, communicate, and argue for or against any construct and expression of their learning trajectory.

Affective engagement focuses on enriching the emotional attachment of learners to the subject to be taught, teachers, peer-group and school. It is a state of self-reporting value of learning, belongingness to family, society and school, and feeling of acceptance or

rejection of the values. In this engagement stage, teachers should provide incentives for learners to participate emotionally in the learning process so that they can internalize the worth of pursuing mathematical knowledge, skills and concepts.

From the above discussion, we see that the four types of engagements seem to cover most of the factors interweaving the learning process; however, the discussion focuses on unidimensional aspects of learning as a form of student achievement. It does not seem to break the narrow view of the top-down approach of pedagogy in which students are recipients of predetermined knowledge sets and teachers become a purveyor of expert knowledge (Crick, 2013). The social and affective dimensions of learning are narrowly perceived as maintaining social orders and a prespecified code of conduct and trying to shape their attitudes according to the normative values and postures of the society and their masters. This disintegrating perspective of engaged learning focuses on a particular element (students' learning output) rather than a holistic learning that un/intentionally promotes a 'piecemeal curriculum' (Darling-Hammond,1997) and 'mindless education' (Langer, 1989). Un/knowingly, these types of engagement serve the first-order desires of the elite group intended to control and manage the education system to their benefit (Habermas, 1973). Realizing the deficiencies of these models of engaged learning, Crick (2012) introduced a concept of deep engagement in learning.

Deep engagement in learning involves learners from the beginning of the selection of learning objectives, pedagogical activities, and assessment of learning as active participants that connect and/or reflect learners' sense of identity. It also embraces participatory inquiry which helps integrate the person with the public, the process with outcomes, and the local with global for a holistic understanding of the phenomena. The deep engagement goes beyond the confines of four walls of the classroom and 'one-size-fits-all' solutions of imposed questions towards more flexible, imaginative and creative ways of designing and implementing the learning trajectory. Learning needs to be personally significant and meaningful to the learner that supports to develop the necessary values, attitudes and disposition and learners' power to handle and engage with new learning opportunities (Crick, 2012). It illuminates that deep engagement is a form of authentic engagement in which learners become aware of their identity, can describe what, how and why they learn, can examine whether learning makes a meaningful connection with their life stories, and whether it enables them to be conscious citizens so that they can make wise decisions and solve real-world problems that they would encounter in their journey (Goodson, 2009). From this perspective, deep engagement is the process of engaging in the learning process (reading, exploring, writing and envisioning) in which learners become empowered and develop their agency so that they can contribute to authentic, inclusive, culturally relevant curriculum, thereby opening the doors for personal and social transformation. In this regard, I explore the aspects of engaged reading and its role in creating transformative learning. Finally, I will present a brief overview of the issue.

Engaged Reading in Mathematics Learning

Engaged reading is the most significant pillar of meaningful mathematics learning. It seems somehow different from other disciplines. Engaged reading does not only entail the concept of reading within and between lines. Active reading in mathematics confers the involvement of learners in exploring, understanding and making meaning of the phenomena with the help of mathematical concepts, ideas, and models that are intense for significant contributions to personal, social, and institutional transformation. It is beyond the conception of learners' engagement in mathematical activities that re/produce and re/confirm the

mathematical knowledge, concepts and skills, solving the textbook problems, and seeking an external recognition of their learning. I do not claim that these ingredients are not necessary for mathematics learning. My argument is that these constituents are not sufficient. These components are obviously retained if we are deeply engaged in mathematical reading. Without deep engagement and understanding of mathematics through active reading, learners cannot differentiate the role of mathematics in picturing a crisis, constituting a crisis and formatting a crisis (Skovsmose, 2021). Indeed, mathematics can help in picturing real-world problems and provides an appropriate resolution of the issues; however, mathematics is not a value-free, neutral and unbiased discipline. It also becomes the part of constituting and formatting the crisis in the burgeoning society. It means that the readers need deep engagement in reading to explore the multidimensional effects of mathematics in society.

In many cases, mathematics supports concealed deep-rooted crises existing in our society, educational institutions and economic spheres of a nation that can spread the misunderstanding and misinterpretation of the involved factors behind these crises (Skovsmose, 2021) and people might become unaware of the true essence of the problems. In this regard, engaged reading is neither simply a process of chanting and remembering the mathematical facts, formulae and rules nor repeated use of algorithms to generate the particular solution to the textbooks' problems. But engaged reading is dialogical, dialectical and collaborative activity (Ivey & Johnston, 2015) oriented to explore the socio-cultural, historical, political, and ideological underpinnings that positively or negatively influence mathematics education. Aligning with these views, Gutstein (2006) has used reading the world through mathematics as a powerful metaphor that can unearth socially unjust practices, economic inequalities, terrorism and violence, lack of access to education and other public services, global crises etc., that un/intentionally inhibit the transformative practices. That is, engaged reading is that process which activates students' minds, hearts and hands simultaneously so that they can comprehend the aforementioned issues through a critical reflective practice and be willing to transform them for the betterment of society and nation.

Engaged Reading as/for Critical Reflective Practices

At this stage, I understand that agentic engagement in reading involves the readers for seeking the meanings and connection of mathematics within the power dynamic of society and the dominant ideology that governs mathematics education practices. To explore the power dynamics and hegemonic ideology, teachers need to understand the socio-cultural, historical, and political embeddedness in mathematics through agentic engagement in reading (Reeve, 2013) that further supports them to become critical reflective practitioners (Brookfield, 2017). In the words of Schön (2017), critical reflective practices happen in three interconnected levels: - reflection-on-action, reflection-in-action and reflection-for-action, which seem impossible without deep and agentic reading of texts and contexts that enhance understanding of interconnectedness and interdependence of the phenomena with socio-cultural, historical, political and institutional settings (Brookfield, 2017; Ivey & Johnston, 2015).

To uncover the nexus of these components and their influence on mathematics education, we need to challenge the deep-seated structuration of educational institutions, and critique past experiences. It is a process of critical reflection-on-action that help to understand oppressive forces embedded in teaching-learning activities which are learned by internalizing the dominant power structure and hegemonic ideology. These attributes are neutralized and naturalized by educational practices which are swirling in the air around us

in families, friendships, communities, culture, and social institutions (Gramsci, 1971). The power and skills of questioning and challenging the dominant structure and hegemonic ideology support enhancing the self-confidence of the practitioners, and thus they can move beyond the accumulation of discrete knowledge, skills and concepts, enabling them to engage wisely in the present actions having the intention of break out the narrowly conceived view of pedagogy and its implication in a classroom (Larrivee, 2000). Likewise, after breaking the boundary of conventional pouring and banking pedagogical practices, practitioners can envision inclusive and empowering pedagogy that might reflect the practitioners' cognitive, affective, and spiritual dimensions and their social, cultural, historical, and political scenarios. Critical reflection is the continuous process of professional and academic development in which practitioners cross through four levels (Brookfield, 2017). Firstly, practitioners deeply engage in contemporary research and theory that provides theoretical and philosophical understanding. Critical-self-reflection is the next stage that helps explore empowering and disempowering experiences. The third stage is a peer-group reflection supports for correcting the course of actions by incorporating their feedbacks and finally students' reflection helps to improve the classroom practices (Brookfield, 2017). It highlights that critical reflective practitioners need to explore multilayered and multidimensional aspects of mathematics through engaged reading that enables them to enact with the immediate environment through wise and conscious manners that must positively impact educational institutions, society and nation.

Engaged Reading as/for Agentic Development

Power and ideology present in the wider sectors of society and nation always intrude into educational institution, thereby into the mathematics classroom. Mathematical activities within a particular classroom are not "limpid, tranquil, and reflective eddies cut off from the river of social, cultural and political life" (Brookfield, 2007, p. 10). It is a microcosm of contemporary society in which many contradictions and conflicts exist among ideologies, values, perspectives, material prosperities, etc., which have rarely been discussed in mathematics education. These factors play significant roles in the formulation of curriculum, selection of contents, pedagogical choices, and assessment practices. Without having critical looks over these components, teaching-learning activities are oriented toward mastering discrete knowledge, skills and concepts. Learners remain ignorant about these factors that further support in perpetuating the assumptions of mathematics as a neutral, value-free, ahistorical and apolitical discipline (Ernest, 2016). These are the principle traditions informing mathematics education practices in our context. From the prolonged enactment of such programs, nowadays, these sets of beliefs and assumptions are accepted as normal and rationale. From the perspective of engaged reading, mathematics should not restrict to mastering the prespecified contents, knowledge and skills but should focus on exploring these factors and their effects on shaping mathematics education practices. For questioning and challenging the presence of dominant power structure and hegemonic ideology and their underpinning informing pedagogy, learners should be aware and conscious, which is only possible when they are willing to be deeply engaged in reading that helps unearth the verminous effect. It illuminates that engaged reading targets to develop agency in the learners to contribute to the betterment of individual learners, society and the nation.

Agency is nothing but the interest or potentiality and willingness possessed by actors that can create empowering, inclusive and socially just action within and outside the school premises. The conventional mathematics education program prevents the path of

developing agency in learners because the development of agency is perceived as extremely dangerous and anathema to those in power in an unjust world who controls the educational institutions according to their interests and ideology (Gutstein, 2006). In this sense, deep engagement in reading is a necessary condition to understand and uncover hegemonic ideology and dominant power structures within and outside the schools that have been entrenched in peoples' beliefs and culture through the indoctrination of capitalism, democracy, positivism, patriarchy, globalization, cast/religious/white supremacy and world standard (Brookfield, 2017; van Stam, 2017). Conventional reading engages the learners in a repertoire of discrete knowledge and skills and uses repeated algorithms to solve undue bookish questions. It supports in socializing them into non-questioning roles, creating and maintaining passive identities so that they feel inferior and lose self-confidence and power to control their own actions that shape the world-what Macado (1994, as cited in Gutstein, 2006) called literacy for 'stupidification'. In this context, engaged reading is a new and constructive way of engaging students in a learning process that allows them to learn from histories, connect mathematics with real-world problems and other disciplines, develop self-confidence that they can change the world, envision empowering and authentic ways of knowing, being and doing so that they can take their sole responsibility and authorships of their learning (Gutstein, 2006).These are some of the attributes of the agentic readers who explore the dogmatic dependence and unfair existence in contemporary society, nation and the world and take autonomous actions by establishing solidarity with the oppressed groups aiming to liberate them. It glorifies that engaged reading is not simply an accomplishment of externally designed tasks to achieve academic achievement. It is a project of developing the consciousness so that the learners become not only aware of the present crisis and deficiencies of the world but also proactively engage in excavating them, aiming to transform the world toward more equitable and socially just ones in which every people can enjoy with their potentiality irrespective of their identities.

Engaged Reading as/for Transformative Learning

From the above discussion, I realize that engaged reading has a multidimensional effect on mathematics education practices. The first and foremost aim is to enhance the level of consciousness of the learners through critical reflective practices that develop the agency in the learners so that they can become change agents. In doing so, engaged reading enables the students to excavate the hidden factors or forces that implicitly govern mathematics education practices and compel them to accept the 'taken-for-granted assumptions' as the knowledge that will support maintaining the 'status quo' in society. That is, engaged reading energizes the learner to scrutinize the socio-cultural, historical and institutional components to promote the relational and critical understanding of the role of mathematics. In this process of deep and agentic engagement, students can make the meaning through their lifeworld that possibly triggers to assess their experiences critically. Engaged reading leads learners to challenge conventional deep-rooted meaning perspectives, values and feelings, and they could envisage a new perspective on learning (Mezirow, 1991). It illuminates that engaged reading not only restricts the teaching-learning activities to conceptual and procedural understanding that promotes the student's academic performance (Nyika & Mwema, 2021) but also enables them to be critically reflective practitioners and develop their agency so that they would be change agents (Lamichhane & Dahal, 2021). That is, engaged reading is the beginning of transformative learning.

Transformative learning deals with the process of acquiring a new meaning perspective by challenging and critiquing deep-rooted meaning scheme which is

indoctrinated by conventional education. Engaged reading that fosters critical reflectivity and enhances the agentic aspect of learning underpin the four purposes of transformative learning (Mezirow,1991). As I have described above, engaged reading helps describe or understand the existing socio-cultural, historical, and political milieu in our context that supports the practitioners to reflect on their preliminary assumptions, values and actions, which is the first purpose of transformative learning. It provides the grounds for critiquing disempowering forces and scaffolds to create new plots or spaces in which alternative visions, meaning perspectives, values and actions are acknowledged for the betterment of human lives (through learning), which is another purpose of transformative learning. Likewise, the third purpose of transformative learning is shifting practitioners' beliefs and actions to improve pedagogical practices, which seem to be rarely possible without engaged reading because of its multidimensionality of exploring, critiquing and evaluating existing situations that endorse adapting alternative visions, perceptive and actions. Finally, the transformative learner engages in transforming deep-rooted habits of minds in terms of the nature of reality, ways of knowing and valuing that inspired them to accommodate new ways of thinking, valuing, and acting by challenging all sorts of disempowering forces embedded in mathematics education to create the better learning space in which authentic learning can take place (Mezirow, 2012). From the above discussion, we can see a strong interconnection and interdependence of these constructs; engaged reading, engaged learning, critical reflective practices, agentic development and transformative learning. These constructs are also discussed by some of the authors who contribute to the research article in this issue. I will present a brief overview of the articles included in this issue in the following sub-sections.

Overview of the Issue

There are six original research articles in this issue, out of which four are related to mathematics education and two are mathematical modeling. Four articles from mathematics cover the issues and problems of curriculum, pedagogy, reflective practices and professional development and students' identity and the remaining two articles explore the issues of advection-diffusion equation describing air pollution spread in a limited atmospheric boundary layer from a continuous point source and study volume flow rate, blood pressure, velocity, viscosity and shear stress of blood by using Poiseuille's equation.

Rameshower Aryal explored the role of critical self-reflective engagement for professional development of mathematics education by autoethnograpical reflection as a research method. He used Habermasian knowledge constitutive interest as a theoretical lens to make the meaning from his lifeworld experiences. He concluded that critical self-reflective practice significantly has improved the professional development of mathematics teacher.

Surendra Ghimire tried to study the gap of intended and implement curriculum in terms of students' socio-economic background. He found that teachers adopted the transmissionist approach of pedagogy that could not connect the classroom mathematics with the socio-cultural context of the children. Likewise, he revealed that languages used in classroom instruction seem problematic for the working class, students. Teachers preparation and development programs failed to develop the integrated skills to the prospective teachers and thus teaching-learning activities in mathematics remained decontextualized. Finally, he argued that the teaching-learning activities were not oriented to meet the national objectives of developing the critical thinking and problem-

solving skills and seemed to impose the middle-class habitus into working-class children.

Bed Raj Acharya and his colleagues studied the mathematics pedagogy and assessment practices of semester system at Tribhuvan University (TU). They used observation, focus group discussions, and guided interview as tools for generating the required information from the three teachers and six students who were selected purposefully. They found that the teachers used collaborative and communicative pedagogical practices along with information, communication and technology (ICT) tools that contributed to student learning. However, there was a lack of sharing culture and teachers and students did not focus on developing creative thinking in mathematics. Tara Paudel and her team explored the undergraduate level female mathematics students' identities construction in Nepal. They employed narrative inquiry design to find the four female participants' identity from Tribhuvan and Kathmandu University, Nepal. Researchers used Vygotsky's cultural-historical activity theory as a theoretical referent to make meaning from the textual data. The result of the study showed that female mathematics teachers struggled with societal bars and discrimination during the phase of identity construction at undergraduate level.

Jeevan Kafle and his friends discussed on Hemodynamic Parameters of Blood Flow in an Artery, the velocity and volume flow rate were studied by using Poiseuille's equation. They discovered that composition of blood and length of vessel effects in flow rate and pressure of blood. They also developed the mathematical model of blood flow that was created by using the N-S equations and computer simulation and analyzed through the graphical method.

Prem Sagar Bhandari, compared an advection-diffusion equation in describing air pollution spread in a limited atmospheric boundary layer form a continuous point source by using statistical procedure and analytical solution. He explored that expected concentration for eddy diffusivity and wind velocity as constants has a worse agreement with the actual concentration than the expected concentration for wind speed and eddy diffusivity as variables.

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