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Article

Teaching and Learning Issues in Mathematics in the Context of Nepal

Ram Krishna Panthi[1] **Shashidhar Belbase**[2]

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Abstract

In this paper, we discussed major issues of mathematics teaching and learning in Nepal. The issues coming from theories such as social and radical constructivism suggest that teachers are not trained to use such approach in teaching mathematics, and there is a lack of teaching aids and materials and technological tools. The issues related to social aspects are gender issues, language issues, social justice issues, and issues related to the achievement gap. The cultural issues are related to the diversity of language and ethnicity. The issues related to political aspects are equity and access, economic status, pedagogical choice, and professional organizations and unions. The issues related to technology include the technological skills, use of technology, and affordance. Finally, we suggest that all the stakeholders should pay attention to resolving these issues by improving the curriculum, training teachers, resourcing the classroom with locally made and new technological tools.

Keywords: Teaching and Learning Issues in Mathematics, Social Issues in Mathematics Education, Cultural Issues in Mathematics Education, Political Issues in Mathematics Education, Technological Issues in Mathematics Education

Author 1
M.Phil. Student of
Mathematics Education
School of Education
Kathmandu University
Hattiban, Lalitpur, Nepal
E-mail: panthirk@yahoo.com

Author 2
Corresponding author,
Assistant Professor
University College
Zayed University
Dubai, United Arab Emirates
E-mail: Z9865@zu.ac.ae

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INTRODUCTION

Nepal is a member state of the United Nations (UN) since (1955). The country has been trying to abide by the international treaties, agreements, and declarations of UN and its organizations in relation to human rights, basic and higher education, economy, and public health. As a result, Nepal adopted the Education for All 2000 and Dakar Framework of Action (2000) (UNESCO 2015). The Curriculum Development Center (CDC) of Nepal also prepared and implemented a National Curriculum Framework for School Education in Nepal 2007. This framework speaks of various provisions of school education focusing "globalization, modernization, decentralization, and localization of curriculum in the Nepalese context" (CDC 2007, p. 1). The framework was based on the following contemporary issues of school education in Nepal – socio-cultural, curricular, educational (norms, values, life skills, employment), technological, linguistic, instructional, assessment related, research-based, and quality and relevancy based. The basis of curriculum development has outlined many important points including integrated, child-centered, basic education in mother tongue, inclusive, local need-based, Sanskrit as a foundation for Eastern knowledge base, IT supported, and life skill oriented (CDC 2007). 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 Nepalese context. Some of these issues are related to theories, and others are practical in nature. 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. In our understanding, most of the public schools in Nepal do not have proper management of the classrooms. They have an inappropriate size of classes, not inclusive seating arrangement, and there is also the lack of technology for learning and teaching mathematics. There is a misuse of technological tools even if it is available.

Classrooms in Nepal are multicultural and multilingual in general because students come to the school from different cultural and linguistic background. This context resonates with what Gates (2006) expressed, "in many parts of the world, mathematics teachers are facing the challenges of teaching in multi-ethnic and multi-lingual classrooms containing - immigrant, indigenous, migrant, and refugee children, and if research is to be useful it has to address and help us understand such challenges" (p. 391). We agree with Gates' opinion that mathematics classroom situation in Nepal is the same as stated above because multi-lingual and different ethnic groups have their own problems in a classroom context. Also, we have the 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 to all grade levels do not fit our culture. We teach foreign mathematics. It has been imposed upon the teachers and students. We feel that it is western mathematics that we are teaching and learning without considering the needs of students, diversity and values of our society, and norms of the eastern culture. In a similar way, Anastasiadou (2008) writes:

> The de facto multiculturalism (…) which now describes the Greek society, … [which] continues to function with the logic of assimilation (…). In the field of education, the adoption of the policy of assimilation means that it continues to have a monolingual and monocultural approach in order that every pupil is helped to acquire competence in the dominant language and the dominant culture. (Anastasiadou 2008, p. 2)

We are blindfolded to accept the imposed theories and practices without considering the richness of social and cultural diversity, geopolitical complexity, and local knowledge system. The dominant

monolingual and mono-cultural western education system are so pervasive that it has severely affected teaching and learning mathematics in our country. In this paper, we have discussed theoretical issues of mathematics teaching and learning based on radical and social constructivism, social issues, cultural issues, political issues and technical issues and we have suggested some practical measures to address these issues in Nepalese context.

THEORETICAL ISSUES

There are many theories and philosophies in mathematics education. Radical and social constructivism are the two philosophies and theories that have been widely debated and discussed in the literature of mathematics education (Belbase 2014). 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 an 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. We would like to present some theoretical issues of radical and social constructivism of mathematics education in this section. The choice of these two dominant theories are based on contemporary debate on whether learning mathematics is an individual or social phenomenon and the nature of Nepalese social and cultural value system.

Radical Constructivism

We realized that students build their mathematical concepts of what they learn through active cognitive and adaptive process (von Glasersfeld 1995). According to this perspective, students should be involved in critical reflection on teaching and learning mathematics. The teaching and learning processes undergo through assimilation, accommodation, adaptation, and reconstruction (von Glasersfeld 1990). The students learn mathematics through active construction of the meaning of concepts they learn through individual re-organization, re-presentation, and re-construction and social negotiation with peers, elders, and teachers (Belbase 2016). However, there are some major issues of radical constructivism in teaching and learning mathematics that arise from mathematically weak students, application of teacher-centered pedagogy, untrained teachers, the existing curricula, our diverse social and cultural context and general lack of hands-on resources for classroom practice.

In our understanding, the theory of radical constructivism focuses on the cognitive process of learning and teaching mathematics which is entirely a mental process. For the success of teaching and learning mathematics in the classroom, students are trained to go through individual and collective mental processes to make sense of concepts they learn and build upon them further concepts. However, it is challenging in our classroom teaching and learning due to large class size and limited or no classroom resources. We consider that mental actions and processes are mediated through what students and we (teachers) do in the classroom. Although constructivism has emerged as one of the greatest influences on the practice of education, our mathematics teachers have not embraced constructivist-based pedagogy in Nepalese context. We are habituated to quick fixes and shopping mall approach to school improvement (Powell, Farrar, & Cohen 1985) without considering the actual process of learning mathematics. According to the students' cognitive, affective and developmental stage, radical constructivist teachers should follow the various teaching techniques focusing more on individual and group presentations, discussions, tests, debates and student decisions, and application of

mathematical models for solving the problems. We are far beyond in giving the subject matters on students' interest and context and engaging students to participate, sharing ideas in the classroom, and actively contributing to the construction of meaning while learning mathematics (von Glasersfeld 2001).

Theory of radical constructivism accepts that students build their concepts of what they learn through active cognitive and adaptive process. Students may give their reflection and argument about the content, process, and product in teaching and learning and they construct the knowledge of mathematics (Leo 1990). However, these phenomena are related to social and cultural adaptation of knowledge and knowing. The role of language and interactions among peers or community of practice has not been well conceived in this paradigm and the excessive focus on the individual process of knowing and constructing knowledge has created a ground for dilemma (Belbase 2014). While adopting radical constructivism, teachers try to give them adequate support in learning mathematics. However, the poor language background of the students, traditional curriculum with content focus, passive students, diversity of ethnic groups, traditional teaching method (focus on rote memorization), and assessment without focus on creation, our diverse socio-cultural context, and lack of inquiry-based teaching and learning practices are some of the major issues for implementing radical constructivism in Nepalese context. Some of these issues are also linked with philosophy and theory of social constructivism. In the next subsection, we would like to discuss some issues coming from social constructivism.

Social Constructivism

There are many issues on applying the theory of social constructivism in teaching mathematics. According to this theory, mathematics knowledge is constructed through social interaction. The mediation plays a significant role in learning mathematics. It focuses that child learn from other or society through active interactions and participation in activities in groups or peers. Scaffolding and guidance are necessary for learners. Vygotsky described Zone of Proximal Development (ZPD) as a distance between child's ability in independent problem solving and potential ability of problem-solving with guidance (Burton 1999). However, there are issues related to linguistic factor, cultural factor, traditional curriculum, conventional assessment system, inappropriate classroom size, passive learners, untrained teacher, use of banking pedagogy, and disadvantaged learners while adopting social constructivism in teaching and learning mathematics. In our experience, it is a debatable issue because the social domain includes linguistic factors, interpersonal interactions such as peer interaction, and the role of instruction of the teacher. The term ‘social constructivism' originated in sociology and philosophy that comes from two sources (Restivo 1988). The first is the social constructivist sociology of mathematics of Restivo, in which he explicitly relates it to mathematics education in Restivo (1988 as cited in Ernest 1991). The second is the social constructivist theory of learning mathematics of Weinberg and Gavelek (1987). It is used in different context, and it impacts on the development of individuals in some formative ways, with the individuals constructing (or appropriating) meanings in response to experiences in social settings.

For us, social constructivism focuses on questions: How to account 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? (Ernst 1991). We feel that an important issue implicated in the second question is that of the centrality of language to knowledge and thought. It is a major controversial issue in the community of mathematics education. In a simple way, the distinction between the individualistic (Piagetian theories or cognitivist theories (radical constructivist theories)

and socially based theories (Vygotskian theories) of learning mathematics is primary distinction among the social and radical constructivist approaches. We realized that mathematics knowledge is both individual and social and it is the human production. Vygotsky's sociocultural theory shifted from individual to collective, but according to Ernest (1991), it is a cycle of individual to a social and social to an individual. Individual knowledge construction means a person who creates schemes and operating this scheme from the community of learners. The community of learners critiques it. He or she reformulates this knowledge. Finally, he or she tries to make consensus from society, and he or she socially negotiates and creates new mathematical knowledge.

The issues from the theory of social constructivism in our context are - our traditional curriculum, conventional assessment system, and classroom size. The objective of our curriculum does not focus on the construction of new knowledge by students or it does not encourage teachers to engage active construction of knowledge by students. The assessment system emphasizes on rote learning and getting good grades in exams. The examination does not measure students' actual creativity and meaningful understanding of the subject matter. It does not give value to the students' lived experiences. Our classroom sizes are not appropriate for teaching and learning in social and interactive settings, or our teachers are not able to do it due to large class size or general lack of knowledge of the importance of group interactions or lack of motivation to do it. Hence, passive learners or rote learners or poor teachers are one of the issues of social constructivism. In our context, it's hard to construct knowledge socially because of passive learners or rote learners and poor teachers. Mathematically poor students cannot reflect critically, and pedagogically poor teachers cannot give the reflection of students shared experience on mathematics. Our teachers are following the banking pedagogy with the linear fashion of inputs and outcomes which is one of the issues. Freire (1970) pointed out that teachers tend to use a banking pedagogy in which they fill students' minds, as containers, with the knowledge that someone has determined they need to know (Fatma, Elizabeth & Thomasenia 2011). This pedagogy hinders the students thinking because teacher transmitted his or her knowledge to students as if they are filling empty vessels with content knowledge.

Hence, theoretically, we are still in the age of transition from traditional to constructivist approach for teaching and learning mathematics in Nepal. Besides radical and social constructivism, we can observe the issues of teaching and learning mathematics in Nepal from the perspective of socio-cultural theories and critical theory. However, these ultra-modern or postmodern perspectives are far beyond the realization of the teachers and policy makers and hence it has not been discussed in the paper. We reflected briefly on theoretical issues coming from radical and social constructivism which is a partial description because it does not include other theories. However, it is not only theoretical issues that act in classroom teaching and learning mathematics in Nepalese context. There are other issues related to the social, cultural, political, and technological aspects that might have a significant effect on teaching and learning of mathematics in Nepal. We would like to discuss them in the next section.

SOCIAL ISSUES

In our understanding, the major social issues of teaching mathematics are issues of language, issues of gender, ethnicity, and social justice in the context of Nepal. We reflect on each of them in brief. The low educational and social background is directly and strictly related to low results (MOE 2013).

Language Issues

The language is not merely a means of communication, but it is also a vehicle of understanding. Students make sense or create meaning in their language. The most efficient way to make meaning or creating a concept of mathematics is in one's mother language. We think, there is a lack of ability and lack of understanding because students' languages are different in our school and home context. The 'official' mathematics is socially and culturally neutral in the context of Nepal. There is increasing awareness of language and its impacts on mathematics learning (Orton 1996). The language forms and strategies we use in mathematics teaching differently favor some social groups over others. We realized that language is one of the major cause of marginalization because our teachers support some students while it may disadvantage other students through the choice of language used in the classroom. Some students might be excluded from the classroom practice due to language as a barrier. Hence, there exists a social class of students that has the poor participation and less engagement in the classroom (Scada 1992) due to the difference of school language different from home language.

The discrimination of teaching and classroom practice becomes the problem of teaching and learning mathematics. Studies have shown consistently that one's social backgrounds are profoundly influential in determining whether or not anyone is likely to perform in mathematics well (Lamb 1997). In this sense, we feel that the social background affect mathematics learning. Nepal is a multilingual and multi-ethnic country. The different social groups such as Gurung, Newar, Tamang, Mushahar, Yadav, Chaudhari, Rai, and Limbu (to name a few) have different languages. Altogether, there are about 125 active spoken languages in Nepal (UNESCO 2015). In our classroom, there is diversity in speaking the language of different students. The teacher may have his or her own language that is distinct from the medium of instruction in the class. He or she teaches mathematics with own techniques using a different language (Nepali or English) which neither belongs to him or her nor some students socially. That method of teaching may not fit diverse situations while observing from the social aspect. Nepal promised to provide quality education by addressing the issue of linguistic diversity. The Dakar Framework of Action (DFA 2000) a motivated Nepal to intervene in the education policy to bring some reform to ensure the rights of diverse ethnic groups to get education in their own language.

> The DFA included six major EFA goals along with twelve strategies to achieve fully by 2015. It is worthwhile to mention here that Nepal added the seventh goal to address linguistic diversity in the country with a view to ensuring the right of indigenous people and linguistic minorities to basic and primary education through mother tongue. (UNESCO 2015, p. 9)

The addition of the seventh goal shows Nepal's commitment to safeguarding the rights of the minorities and indigenous communities in Nepal. However, it has been a big challenge for the country to provide the textbooks and other resources in more than hundred mother languages.

The National Curriculum Framework for School Education in Nepal outlines some of these challenges. It states that providing school education in mother tongue in Nepal has been challenged by many factors:

> …heterogeneous communities with diverse lingual and socio-cultural structure, lack of development and management of teachers for bilingual education, lack of community

> initiation in managing mother tongue teachers, and lack of script, grammar, dictionary and writing practice in most of the mother tongues. (CDC 2007, p. 19)

These factors contributed to the inequity in the educational opportunities to students from different ethnic groups whose mother tongue is not Nepali. That means there is a high inequity between the various language groups in Nepal in terms of the highest and lowest achievement of students.

The next social issue is the gender issue in education general and mathematics education in particular. We would like to discuss this issue in next subsection.

Gender Issues

There is an issue of differential attainment between genders. The female students may have less interest in studying mathematics beyond schools in our context. There are so many causes behind girls not liking to continue mathematics at the higher level. The parents might give less priority to the daughters, and their daughters are not getting equal opportunities as their sons. The early marriage can be another reason for women not choosing mathematics at a higher level. They have an extra burden to take care of home and accomplish the responsibilities. The belief that women have the inherent capacity as carers and nurturers than taking the challenge to learn a difficult subject is another social taboo. Therefore, women do care and feed children than men do in our context. Therefore, the issues of gender are more challenging in teaching and learning mathematics providing equal opportunity to both boys and girls in schools. There are social barriers to go to study in schools for many girls. In our Muslim culture in Nepal, most of the families or parents want to send their daughters to Madarashas or single sex (female only) schools. But there are only a few numbers of Muslim schools (i.e. Madarashas) in Nepal. Hence, the disparity of male and female child is due to the social factor. Our society is the male dominated, and our mathematics classrooms are also male dominated. In our experience, females have poor participation and performance in mathematics classroom in general. This can be seen in their performance in mathematics. The NASA report (MOE 2015) shows that male students outperformed girls in mathematics all geographical regions in Nepal in all content areas. This issue has been reported to be true for all ethnic groups in Nepal (MOE 2015).

A study by Mathema and Bist (2006) found a strong positive correlation between gender and students' performance in the School Leaving Certificate (SLC) examination. This study found that boys were doing much better in mathematics and other subjects than girls. The major reasons for this discrimination in SLC result has been attributed to discriminatory and differential treatment received by girls both at home and at school. The study also found that "most families do not offer conditions at home necessary for girls to do well in schools and they must spend significant hours in household chores (more than 6 hours per day in some cases)" (p. 423). The study also found another reason for the discrimination was that "the amount of support and attention that girls receive inside and outside classrooms from their teachers is minimal compared to the boys" (p. 424). There is a trend that many parents send their male children to private boarding schools for study whereas they send their female children to public schools. This discrimination is pervasive in rural Nepal especially when private schools are far from home. The gender discrimination is also reflected in the curriculum and textbook writing too. A study by UNESCO (Koirala & Acharya 2005) found that there is gender bias in school mathematics less favoring girls compared to boys because of teachers' gender stereotyping views of girls' roles and responsibilities in family and society.

Ethnic Issues

Another issue in Nepalese context is ethnicity. There are the different ethnic background of the students and teachers. In our context, they represent the various social classes in our mathematics classroom. But, our mathematics curricula have been designed with a preference to certain social groups over others. Hence, mathematics education tends to favor one dominant social class over others. It is important to include the students' social and ethnic identity in their learning process. Most mathematics teachers in Nepal do not care about how the ethnic background affect in teaching and learning mathematics. Our curriculum has already been structured and designed that does not focus on the certain target or setting groups. There are different ability groups and disability groups when observed through social aspect. The teachers always focus on ability groups. The teacher is always less responsive to individual demand of the students. They always concentrate on the learning of average or above average students without caring much about the low performers putting all blames to their personal ability or disability to learn mathematics. The diversity of ethnicity could be a rich educational source and inspiration for Nepal. However, it has been considered as a hindrance to providing quality education to all students.

> The national census 2011 revealed that there are 125 caste/ethnic groups and 125 languages spoken as mother tongue in Nepal. Addressing this issue has enormous implications for the education sector to reach out the diverse ethnic groups to provide education and literacy for all, especially concerning provisions of curriculum, textbooks, and teacher training in their mother tongues. (UNESCO 2015, p. 1)

This statement of UNESCO (2015) clearly outlines the key issues related to ethnicity that brings adverse effect in education in general and mathematics education in particular. It has been an issue because the government has not been able to provide curricula, textbooks, and teacher training to all teachers to teach mathematics in students' mother tongues. It is not possible for teachers to know all the languages that students might speak in their family and it has been difficult for the government to provide support teachers to students who need help in mathematics in their mother language. The comparison between the performances of the ethnic groups was worth pursuing and "there were differences in the performance of different ethnic groups (Educational Development and Service Centre (EDSC 2011, p.45). A study shows that:

> Rai, Limbu, and Magar students are over-populated in the lowest performing student group and Urdu, Tamang, Newar, and Sherpa students in the highest performing student group. There is also a difference between the castes: Dalits, Alpasankhyaks, and Madhesis are over-populated in the lowest performing student group and Brahman and Chhetri students are overpopulated in the highest performing group. (Metsämuuronen & Kafle 2013, p.389)

This result shows that the students' performance in school education is skewed toward those ethnic groups who speak the Nepali language as their mother tongue positively and who speak Nepali but that is not their mother tongue negatively. Hence, the educational outcome shows a biased result due to the ethnicity and related language factor.

Social Justice Issues

The next issue is social justice. It is necessary for educating the mathematics learners and teachers about social justice. In our opinion, when the teachers deliberate their knowledge to the students, there is a hierarchical position of the teacher and students. There is a power relation between the students and teachers. The teachers may observe the social status of students (or their families) and

treat them accordingly by discriminating based on social class. The students have a different position in the classroom based on which social group do they belong to and how they present themselves in the class depends on where they come from. These are ongoing unfair practices in teaching and learning mathematics in Nepal, and these practices are the primary causes of social injustice in the classrooms (Panthi 2016). This problem raises another issue as a tailing effect on inclusion. This issue leads to classroom teaching that may not be inclusive. The classroom may not be appropriate or just for teaching and learning mathematics. The teacher does not care all students equally because he or she focuses on the first rows of good students. There might be some disadvantaged students in a classroom due to the lack of fulfilling their needs of mathematics learning. In our opinion, the teachers might not be able to satisfy needs of all the students in the classroom because of different background of the students that naturally favors some and disfavors others. They may create a different hierarchy of students in the classroom in terms of their social status and in terms of their performance in the class. Also, the teachers may not focus the disabled students. At the same time, the teachers should teach many students in a classroom (in most of the public schools in Nepal) because of lack of classrooms. These problems reflect in the educational outcomes of public schools with low performance of students compared to the private schools (MOE 2015). The National Curriculum Framework for School Education in Nepal 2007 states that:

> From the point of view of access and equity, the principle of positive discrimination needs to be adopted for the expansion of education. Therefore, the nation should make special provision for women, helpless and senior citizens, orphans with disability and economically and socially backward community. Furthermore, it should safeguard the right to education in mother tongue, guarantee the child rights and provide free basic education. (CDC 2007, p. 19)

That means the document shows the commitment of the government to provide equal access to education for all despite gender, age, and status of one's life. The implementation part raises the serious issue in equity of quality education for all in general and mathematics education in particular. These issues lead to the issue related to students' achievement in public schools in Nepal that we have discussed in next subsection.

Achievement Issues

There is a huge gap of student achievement in mathematics across the geographical region, ethnicity, and gender (MOE 2015). Recent study on National Assessment of Student Achievement (NASA) reported that –

> In mathematics, the average achievement score is 57% in the private schools whereas it is 26% in the community (or public) schools. However, it is not clear whether it is due to the effectiveness of instructional processes in the institutional schools or manifestation of the disparity of socio-economic status of students in these two different school systems. (MOE 2015, p. vii)

This disparity in the achievement in private or institutional and public schools has been a source of social inequity in mathematics education. There is also a difference in the achievement of Dalit students compared to students from other communities in Nepal creating another gap in the achievement in mathematics (MOE 2015). The NASA report also suggests that there is a wide gap in the students' achievement between rural and urban schools in Nepal and this gap is about 24% in the grade 8 (MOE 2015). The same report indicates that many students (about 37%) were never assigned any homework by their mathematics teachers and their achievement was found to be lower than other

students who were assigned homework. The overall performance of students in mathematics in Nepal has been found to be right skewed (right-tailed) indicating that many students had a lower grade than the median grade. At the same time, the performance or achievement of students has been found to be influenced by parents' education in a positive way (MOE 2015). The achievement gap in all areas of education in general and mathematics education has been a fundamental issue in Nepalese education despite many efforts by the government and non-government organizations. In a report, UNESCO states-

> Male-female gender gap though decreasing is still noticeable and prevails across almost all castes and ethnic groups, rural and urban areas, eco-zones, development regions, and income groups. Huge gaps exist in educational access in terms of gender, social groups, location, disabilities, and level of income. The quality of education and students' learning achievements at all levels of education (from kindergarten to higher education) remain one of the foremost challenges of the education sector in Nepal. (UNESCO 2015, p. 6)

The gender gap has been one of the major concerns in the educational outcomes in Nepal. Also, there is a huge disparity in the educational attainment of students in general and mathematics based on other socio-economic factors beyond gender.

Hence, it seems that there are many social issues in teaching and learning mathematics in the context of Nepal. These social issues are intertwined with cultural issues. Therefore, we discuss the cultural issues in the next section.

CULTURAL ISSUES

There are many cultural issues in teaching and learning mathematics in the context of Nepal. Nepalese schools are practicing one-way border crossing (Giroux 1992 as cited in UNESCO 2008). That means the students leave their own family culture outside the school and enter the school that is different from their home culture. Because of this difference in the home and school culture, many students struggle to learn mathematics that is even more decontextualized from their community and society (UNESCO 2008). In Nepalese classrooms, these issues are - the issue of inequity, inequality, gender issue, the issue of native language, issues of ethnicity, and the issues of traditional curriculum. I think they are all cultural matters that are more or less linked with social and political aspects too.

Diversity of Culture

Nepal has multicultural and multilingual communities residing in all parts of the country. According to the National Census of 2011, there are 125 ethnic groups in Nepal contributing to immense cultural diversity in the small land area of 147181 square kilometers (UNESCO, 2015). Each ethnic groups and sub-groups have different cultural traditions and festivals. The different cultural festivals may affect our teaching and learning mathematics. The students are absent for many days because of the local festivals. They do not learn individually. That affects the learning performance. Most them are weak in the subject (mathematics). Our teachers might lack the skill of teaching technique to the students in the different cultural background. According to Olstad, Foster, and Wyman (1983), teachers who lack multicultural education are not well prepared to face the challenges of a pluralistic society and hence they tend to have low expectations for minority children. Therefore, it is tough for teaching and learning mathematics in the diverse cultural groups of students in the context of Nepal. There are different hierarchical positions of individuals in our culture in Nepal. The

teachers have higher positions and students accept their teaching without any doubt, and this authoritative position has given a privilege to the teachers to act in their own way. The culture of respecting ‘guru' without questioning their approach might have brought them in an unchallenged status, and this has been a hindrance to transform teaching and learning in Nepal. Although, we should focus on cultural norms, values, and practices that are important in education, but also we should be aware of some malpractices such as girls being absent in class during menstruation cycle due to cultural belief and practice that they should not touch or be close to others during that time. In many cultural and social groups, early marriage is another issue that may affect schooling, and that may negatively affect interest to learn mathematics.

We think, there is a cultural inequity in teaching and learning mathematics Nepal. There are different cultural backgrounds of students in our classroom. It seems that Brahmin and Kshetri (Khas in general) culture dominates other cultures (such as Dalit and Janajati such as Tharu, Yadav, Kumal, Magar, Rai, Limbu, Sherpa, and Gurung, etc.). There is an unequal cultural power relation among these cultures, and that is clearly reflected in the classrooms too. These are barriers to the teaching and learning mathematics because the Brahmin and Kshetri students are dominating the Dalit and Janajati students till now. Brahmins' feel superior themselves than others ethnic groups. The Brahmin teacher also dominates the Dalit and other caste students. Therefore, it is difficult for some students to cope with teaching and learning mathematics in the classroom.

We agree that multicultural issue in the present context is a concern in most of the classrooms in Nepal and it has been accepted as a global issue of social, cultural, and political in nature, but inevitable in education. It is also related to one’s personal and social identity in schools and classrooms. Schools and classrooms in Nepal have problem based on social class and hierarchy of caste system (Subedi 2010). Such issues are reflected in mathematics teaching and learning when it comes to student’s ownership of what is learned that is beyond his or her cultural identity and the mathematics he or she learned is detached from the cultural milieu. The cultural diversity in the country should be a golden opportunity to practice diversity of knowledge and experiences, but it has been considered as an issue in Nepalese education system in general and mathematics education in particular because the cultural identity of students coming from different ethnic and caste-based communities has not been addressed adequately in the curriculum, teaching and learning, and assessment system (Davis, Phyak, & Bui 2012).

Diversity of Language

We discussed language issues in the part of the social issue. However, we would like to bring it here again as a cultural issue. According to Lewis (2009), there are 126 spoken languages in Nepal and this number has been reported as 144 by Yonjan-Tamang (2005). These languages have been dominated by Nepali and English in schools in Nepal (UNESCO 2011). Although primary education in many schools has adopted classroom instruction in children’s first language with positive results of increased interaction between students, students and teachers, and parents and teachers, and improved students’ performance, it has been an issue again once they complete their primary school. In some community, the teacher does not understand students' native language. Students do not understand the language of teacher. Then there is a problem in teaching and learning mathematics. Some of the families do not understand the national language Nepali in our context. Then, they cannot help their children at home too because of the difference in cultural of speaking and writing at home and in the school or classroom. However, a study by UNESCO (2011) shows that “parents are not ready to

accept teaching only in Magar language, and that they also demand teaching of a few subjects in English" (p. 21). Thus, we agree with Fraser's (1995) statement:

Demands for "recognition of difference" fuel struggles of groups mobilized under the banners of nationality, ethnicity, 'race', gender and sexuality. … And cultural recognition replaces socioeconomic redistribution as the remedy of social injustice and the goal of political struggle (p.68).

These issues are not originating from schools itself, but from the wider social and cultural context. Such factors include early marriage, pregnancy and family responsibilities after the wedding (Chimomo 2005). The general understanding at this point is that we need to make our mathematics related to the learners' cultures. We can lay the foundations of mathematics that may arouse learners' interests and challenge their intellect early in life based on their cultural experiences, but it has been largely ignored in the mainstream education policy in general and mathematics education in particular (Kroma 1996). Our mathematics teaching and learning could not be culture friendly. The mathematics curricula in Nepalese schools lack contents and specific strategies that enable the teachers making connections to cultural aspects explicit in the context of teaching mathematics. Studies based on the concept of cultural differences make an assumption that learners come from culturally different backgrounds. They may achieve academic excellence if classroom instruction is conducted in a manner responsive to their home culture (de Beer 2010). Again, we think, this aspect has been largely neglected fact in the context of Nepal. We are still adopting the traditional curricula or a Tylorian model of mathematics curricula which is one of the primary reasons for perpetual social and cultural issues in teaching and learning mathematics. The contents are incompatible with the students' values and cultural norms, and hence misunderstanding of content in general and distrust to the mainstream policy are likely to ensue because mathematics curricula are designed with top-down approach, and there is lack of ownership of teachers and parents to such curricula (Croninger 1991). There is no proportionate representation of culturally diverse students in programs for exceptional children i.e. marginal and disadvantaged children (Epstein, Polloway, Foley, & Patton 1990).

The new constitution of Nepal (2015) has guaranteed the right to education in mother tongue until highschool. It states that "Every Nepali community living in Nepal shall have the right to acquire education in its mother tongue up to the secondary level, and the right to open and run schools and educational institutions as provided for by law" (Part 3, 31.5). This provision is not a new one. The country had a similar provision in the Interim Constitution 2007. Also, the government has introduced this provision in the National Education Framework for School Education in Nepal 2007 (UNESCO 2011). However, the implementation part is the main issue in Nepal. The government of Nepal and educational institutions do not have a clear vision of how to implement the multilingual education in general and mathematics education in particular beyond primary level. The diversity of students' cultural and linguistic background and the teaching style of their teachers, the culturally pre-determined expectation and pre-structuring curricular contents are the attributions of poor results in school mathematics in Nepal. These cultural and linguistic issues have a tailing effect on the politics in general and politics of mathematics education in particular. We would like to discuss the political issues in teaching and learning mathematics in Nepal in the next section.

POLITICAL ISSUES

The major political issues of teaching and learning mathematics are the issue of equity and access, the issue of poverty (economic status), the issue of pedagogical choice, and professional organizations and unions. The National Curriculum Framework for School Education in Nepal 2007 states that "economic, social, cultural and the political situation of the country are the major

hindrances in maintaining the expected educational standard" (CDC 2007, p. 28). That means political issues, among others, have been accepted as a reality for low performance in public schools in Nepal. We would like to discuss some of these issues in separate subsections as following.

Equity and Access

The issues of equity and access in mathematics education are one of the main issues in the context of Nepal. There is inequity and not getting equal access to teaching and learning in the mathematics classroom. This is a grave and critical political issue. In our classroom teaching and learning of mathematics, each student cannot get equal opportunity in the classroom activities because of the inappropriate classroom size, the number of students, and the application of traditional pedagogy. Teachers might focus on good and intelligent students in the classroom. Generally, he or she does not care poor students. Some of the teachers discriminate their students based on their ethnic and family background while teaching and learning. This does not sound a good teaching at all. Sometimes the administrators of the institutions are biased to the students. They do not provide scholarships to the target students. They distribute the scholarships to near and dear relatives. That kind of behavior may affect the performance and attitude of the students. The negative attitude develops toward the institution and the teacher.

In a study, Chimomo (2005) conveys that resources are not equally distributed equitably, which is true in the case of Nepal too where urban schools are getting more and better resources than the rural schools. It seems that urban schools have more or less a better opportunity to have facilities of modern technology, physical infrastructure, qualified teachers, etc., than the rural schools. Hence, the urban school learners are, on the average, given better opportunities to education in general and mathematics education than the rural students (Kazima & Mussa 2011). Providing equal facilities to all rural schools like urban schools is a political decision. If the government is capable, it can provide the resources (technology, textbooks, libraries, classrooms, trained teachers, and other supports) to rural schools as well. Hence, the politics of the country influences the teaching and learning mathematics from school to university level through policy and distribution of resources. UNESCO (2015) pointed to "the major issues and concerns with respect to ensuring the learning needs of all young people and adults relate to three major aspects – out of school population, school-dropped-out population, and formal education graduated population" (p. 25). These issues are directly related to equity and access to learning life skills by young and adult population. Mathematics education is also a part of life skill to develop creative and critical thinking and problem solving in day-to-day life (Board of Studies New South Wales 2007).

The Government of Nepal has been trying to guarantee equity and access to education for all that also affects in ensuring equity and access to mathematics education. According to UNESCO (2015), Nepal adopted different programs (e.g., Basic Primary Education Program – I, 1992-1998; Basic Primary Education Program – II, 1999-2004; Education for All 2004 – 2009; and School Sector Reform Plan 2009 – 2015) to ensure the equitable access to education by all school age children in Nepal. These programs and plans tried to promote school facilities, train teachers, provide support to students with textbooks, scholarships, dress, and even food. However, the outcome is yet not significant to improve the overall performance of students in mathematics. The public schools have not been able to deliver high achievement in school leaving certificate (SLC) exam in mathematics. Each year majority of failures in SLC are in mathematics, and among failures, most of them are Dalits and girls (Mathema & Bista 2006). Another example, the report of a survey carried out by the Department of Education and Science (DES) in England asserted that the teaching mathematics in

many secondary schools was teachers dominated and pupils were not encouraged in creative thinking and inquiry (Koirala 1991). The same thing was also found in Nepal. But, in addition, no instructional materials other than blackboard, 'chalk and student geometry box (while doing, construction works) were used in mathematics teaching in Nepal (Koirala 1991). Hence, the lack of resources in public schools in Nepal has severely affected the equity and access in mathematics teaching and learning. These issues lead to issues related to poverty that we discussed in the next subsection.

Economic Status

The poverty, in general, is the next challenging issues in teaching and learning mathematics in Nepal. In mathematics education, a great deal of ground-breaking work, over many years on gender and ethnicity are established which are the attributes worthy of continuing consideration (Fennema & Leder 1990 as cited in Lim & Pateman 2013). Research has shown that impact of poverty has a negative correlation to students' performance in general (Bracey 2009 as cited in Lim & Pateman 2013). We agree that the poverty is not an attribute of individual, but it exists as a condition with secondary consequences (Lim & Pateman 2013, p.246). The poverty affects the performance of the children in a negative way because this effect can deal with all attempts of government and society to achieve "a greater equity and access to education in general and to mathematics education in particular" (Lim & Pateman 2013, p. 246). Some of the students in public schools in Nepal come from the very low socio-economic condition. The result is that they are frequently absent in school. They should leave the school in mid of the session to support their family working as laborers in the construction and farms of others. They have many problems due to weak economic statuses such as eating, living, and clothing which are their priorities before attending the schools. The socio-economic status of parents has a negative effect on their performance in mathematics in Nepal (MOE 2015). This scenario directs us towards the need for improvement in the economy to improve the education of all children in Nepal. We can see that there is a huge gap between poor and rich people in our country. We believe that the primary sources for such diverse economic disequilibrium come from politics because it has the power to promote or demote economy of the country despite all other factors. If the politicians do good works for improving people's life through enhancing the economy, then they can reduce the gap between wealthy and poor people, at least for equal opportunity to learn mathematics (and other subjects) by all. Due to low socio-economic status, many school children in Nepal work at home after their school each day. The hour of working at home other than study has a negative effect on students' achievement in school. A report of Ministry of Education states:

> Working beyond the school hours reduces the school achievement of the students. The phenomenon is most probably connected with the poor economic situation in the family. Especially, when the children need to work more than 2 hours per day either paid or unpaid, the achievement level is remarkably lower. Achievement is better if they are working 1 hour or less per day. (MOE 2013, p.166)

That means more students are engaged in the domestic chorus to support their parents, more negative impact it has on their education because they get less time for study, they get tired and exhausted and cannot concentrate on their study at home. The economy at home has a political aspect because the politics and fiscal policy influences the household income, jobs of parents, and the overall support that students receive in schools and outside for their education.

Pedagogical Choice

We believe that teachers' pedagogical choice is a part of their political decision in relation to which they are empowering or disempowering students in the classroom through their actions. Generally, in Nepal, mathematics teachers mostly apply traditional pedagogy such as lecture method and transmission approach. This kind of situation may create a social injustice because students do not have the opportunity to learn at their pace and learn through interaction and negotiation (Panthi 2016). It may be unfair to some students just to continue lecturing and not giving them the opportunity for reflecting on what they learned. This banking pedagogy produces the good, average and bad position of the students in a classroom teaching and learning. Despite the mathematics curriculum that suggests student-centered and joyful learning, the teachers are adopting a traditional chalk-and-talk approach in Nepalese schools (Nakawa 2013). This segregation may be considered as a source of discrimination based on students' performance. The good students show the power among all other students. They feel superior in the classroom and it affects their identity in society. They have a better opportunity to study technical subjects in the higher level. But, the low and average performing students go to study general disciplines such as social sciences. This issue is a big challenge from a political point of view because there are many low and average performing students in our country and they are left behind deliberately. This case goes further to equal access to educational opportunities.

The pedagogical choice of teachers to engage students in higher order thinking, reasoning, and problem solving has a direct influence in their performance. Many students in Nepali schools can solve basic mathematics problems, but they are not competent in critical thinking, reasoning, and problem-solving, especially working on "the open-ended questions of higher cognitive level" (MOE 2015, p. viii). The National Framework for School Education in Nepal 2007 outlines some key issues in school education in Nepal including "lacking tri-polar (teachers, students, and guardians) interaction in teaching" (CDC 2007 p. 21). The problem lies in the teachers' pedagogical choice in not involving students in interactions and not inviting parents to engage with their children's education in general and mathematics education.

Professional Organizations and Unions

When we discuss political issues in teaching and learning mathematics in Nepal, we cannot and should not forget the roles and responsibilities of the teachers' unions. Almost all the teacher unions in Nepal are factions of political parties. They are aligned with a political party based on ideological reasons. Then, their priorities and actions are not motivated by the need of students and need of schools, but by the political agenda of their mother political parties. Hence, their focus is not on the professional development of teachers although, sometimes, they raise issues related to political protection of their profession rather than qualification and skills. That means they focus on political agendas rather than academic. In our opinion, they should focus on educational program and quality of teaching and learning in general and teaching and learning mathematics (and other subjects) in particular. The teacher unions look everything through the lenses of politics and ideology. The unions are severely affected by the politicians and their party agenda. This issue reminds us the views expressed by Lim and Pateman (2013):

> The utilitarian perspective may be described as conserving the status quo, but the political solutions offered by the liberal or humanist perspective are aimed at transforming society through the emergence of individuals who have sought their own pathway and who will bring new insights into problem solving. Somewhere between the two ideals, utilitarian and liberal, can, perhaps, be found the politics of the practical as the small numbers of the highly

> influential negotiate with the masses whose members each have limited individual power in the continuing struggle between different classes. (Lim & Pateman, 2013 p.246)

In utilitarian perspective, mathematics course that prepared the students to work and in liberal perspective, the teaching and learning should be transformative. The teaching and learning mathematics should be related to the lived experiences of students to promote their thinking and changing their life positive way. There is a problem of negotiation because of poor students and untrained and unprepared teachers. They cannot do these highly intellectual exercises.

There is also a lack of cooperation and collaboration among the subject teachers in schools in Nepal (CDC 2007). The school community relationship is also not strong in many parts of the country (CDC 2007). Then parents are not informed about what's going on in schools and classrooms. So, there is inequity because parents are not informed and students do not get equal access to classroom teaching and learning. Teacher unions are fighting for their own rights in terms of job security and benefits and they are less concerned with the quality of mathematics education. According to Wagley and Jha (2013), "because of teacher unions the Ministry of Education has not been able to manage teacher positions for the past two decades" (p. 12). The professional organization of mathematics teachers in Nepal, for example, Council for Mathematics Education in Nepal (MEC), aims to promote mathematics education through trainings, workshops, and publications. However, these efforts are limited to certain districts. Its role is more like an advisory for the Ministry of Education and other agencies and has not been very effective in developing professional skills of mathematics teachers, licensing processes, and teacher development in public and private schools in Nepal. Another professional organization of Nepalese mathematicians is Nepal Mathematics Society which aims to promote professional ethics and welfare of teachers and researchers in mathematics and to enhance the popularity of mathematics at the local level. These objectives seem to be more aligned toward fulfilling the needs of the professionals and not the society as a whole.

More than a dozen teachers' unions and associations existed in Nepal and they agreed to merge to form a single umbrella body in 2014 (Kathmandu Post Dec. 22, 2014). This merger was for advocating the rights of the teachers, and not for quality enhancement of education in general and far beyond mathematics education. In this context, Shrestha (2008) stated that the teacher unions in Nepal have some activities as follows:

> All major political parties made special efforts to have their teacher unions, and teachers had been enrolled in the party affiliated teacher unions. Teachers had been allowed to actively participate in the political activities. The facility enjoyed by the teachers to get transferred was highly misused. Thousands of teachers from rural and remote areas started to pressurize the party government to get transferred to urban areas. The teachers opposed decentralized school management system. (p 46-47)

These points clearly outline the issues that teacher unions are concerned with safeguarding their rights and job security without the much considering quality of education in general and mathematics education.

Some of the issues discussed above come from theories and social, cultural and political practices. However, at the same time, we have been dealing with fast growing technology in all sectors of life, and this has a huge influence in education. Technology has changed the way we do things, the way we think in general and the way we teach and learn in schools too. Hence, we would like to discuss some issues related to technology in teaching and learning mathematics in Nepal.

TECHNOLOGICAL ISSUES

Nepal started technology application for teacher education since 1970s through Radio Education Teacher Training Project funded by USAID (Holmes 1990). The project introduced the Radio Mathematics Program to selected schools as a piloting project in 1989 (Holmes 1990). Since then, the Government of Nepal Ministry of Education has been training teachers through radio education. These efforts could train thousands of primary school teachers. However, the country still lacks a broader application of technology in teaching and learning mathematics. These programs made the rest of Nepal dependent on Kathmandu for resources both human and physical (Holmes 1990). These days too, there are wider applications of Internet technology by the public, but almost none in teaching and learning mathematics in rural areas. The major issues of teaching and learning mathematics with technology are the lack of knowledge of technology, affordances and constraints in teaching with technology, and the issue of using technology in the particular area of mathematics. The National Curriculum Framework for School Education in Nepal 2007 outlines some key guidelines for technology integration in education. However, the same document accepts that there has been an issue in the practical implementation of ICT in education in general and it can also be an issue mathematics education. It states that "ICT has not been properly addressed by the curriculum. ICT as a subject or as a tool of teaching learning has not been clearly defined" (CDC 2007, p. 18). The Ministry of Education and Sports (CDC 2007) promised to include ICT in the school curricula either as a separate subject or as a medium for other subjects including mathematics to bring educational reform. Now emphasis should be shifting from the use of ICT not just as stand-alone technology, but it is a tool for teaching and learning different subjects including mathematics in Nepal (Karmacharya 2015). The Ministry of Education (MOE) of Nepal does not have a concrete micro-level policy regarding how to support each school and teacher in the implementation of ICT in classroom teaching and learning integrated with mathematics and other subjects despite the formulation of macro policy (Wagley & Jha 2013). We would like to discuss technological issues in teaching and learning mathematics in terms of knowledge of technology, use of technology, affordance of technology, and the role of technology in the following subsections.

Knowledge of Technology

The existing school mathematics curriculum in Nepal lacks a clear direction for teaching and learning mathematics by using technology. Many mathematics teachers have a lack of relevant skills to use computers and applications to use in teaching mathematics. Many of them do not know how to use Excel Spreadsheet, Geogebra, and other applications for teaching arithmetic, algebra, and geometry in general. Also, there is a shortage of technological tools for teaching mathematics in many schools in Nepal. Many public schools in Nepal, like in other developing countries, lack tools and support staffs for ICT to make accessible in classrooms (Garegae 2015). There are so many approaches to applying technology in mathematics classrooms. For this, the role of the teacher is key (Zbiek & Hollebrands 2008) and their orientation to use of technology is also another challenge (Schoenfeld 2011). We also think that the teachers' perception of mathematical knowledge and method to learn it (Zbiek & Hollebrands 2008), their mathematical content knowledge, and their knowledge for teaching, pedagogical teaching knowledge (PTK) (Shulman 1987), and technological pedagogical content knowledge (TPACK) (Mishra & Koehler 2006) incorporate the principles, conventions and techniques required to teach mathematics with the technology. Many mathematics teachers in Nepal are not familiar with these views and practices. The National Curricular Framework for School

Education in Nepal 2007 has highlighted the importance of integrating technology in teaching and learning, but it also points to the issues of general lack of ICT in the curriculum (CDC 2007).

The Ministry of Education provides trainings to many school teachers each year to promote the use of ICT education. The trainings are provided to the teachers who teach the ICT related course in schools or help children under the program One Laptop Per Child (OLPC) (Wagley and Jha 2013). These trainings have been limited to the computer operation (Wagley and Jha 2013) and they are not integrated into the teaching and learning of mathematics and other subjects. In this context, the application of computers in mathematics education has not yet been fully realized in schools in Nepal although some private schools have been using different computer applications including GeoGebra in teaching mathematics. Many teachers of mathematics in Nepal may have informal knowledge of technology (Computers and Applications), but there is no concerted effort to help them in technology integration in mathematics education (Panta & Dhakal 2015) beyond general personal use.

Use of Technology

The application of these theories related to technology in the classroom practice depends on how teachers value technology and the nature of learning mathematical knowledge as well as crucial affective aspects, such as teacher confidence in using them (Thomas & Palmer 2014). The study by Lagrange and Dedeoglu (2009) indicated that in the context of ordinary classes, there was a high level of teacher expectation about technology use, but there was a quite low degree of integration in practice. We can see this issue with two aspects- teacher expectation to use technology and potentiality of the actual use of technology. To establish a link between these two aspects, teachers require encouragement and support. This issue relates to Ruthven (2012) five suggestions to technology application in teaching mathematics in general, and it can be also applied to the context of Nepal - working environment, resource system, activity format, curriculum script, time available to teachers, and economy. We come to the issues related to the economy, and it directly affects affordances of schools and community to acquire technology for the classrooms. However, there is a growing tendency of information and communication technology (ICT) in Nepal.

> Access to public or private communication has changed quite drastically – 50% households have a radio, and similar numbers own a TV set, 75% use mobile telephone which is a sharp increase from around 6% in 2006 and 9% have a non-mobile telephone. (UNESCO 2015, p. 5)

These technological tools might have a great significance in teaching and learning mathematics. In our understanding, they are largely ignored in the classrooms or out of classrooms in Nepal. The school mathematics curriculum of Nepal does not mention any technological tools and their applications in teaching and learning mathematics although it mentions that local materials and problems from local context should be included in the teaching and learning process (CDC 2011).

Affordance of Technology

We believe that affordance of schools to technology can be related to constraints in teaching mathematics with technology. In our context, most the students and teachers in public schools cannot afford the new technology in general. It is very costly for them to have computer labs in the schools and it is very expensive for many parents to purchase a computer and connect to the Internet for their children to use at home. Most of the schools do not have mathematics labs with computers and overhead projectors, smart boards, and other tools. This issue is not limited to the schools,

community, and parents, but it is the national issue in teaching and learning mathematics with technology. Lack of affordability of the technology typically used for teaching also has equity implications in general (Pierce & Ball 2009), since the perceived advantages of this technology for supporting student learning and examination use are not equally available to all students in the public schools of Nepal. Many teachers, parents, and students have realized that the integration of technology in teaching and learning mathematics is needed in our classroom. The integration of technology in teaching and learning mathematics helps in creating collaborative teams and working groups to help each other among the teachers and students as a part of teacher professional development (Trigueros & Lozano 2012).

There is a growing tendency of use of ICT in day-to-day life in Nepal due to decrease in the price of ICT equipment (computers and laptops) and expanding Internet connectivity (Bhatta, 2008). The Government of Nepal has introduced some measures to enhance the application of ICT in education with policy and practice. It has introduced the IT Policy (2010), SRRP (2009- 2015) and Three-Year Plan 2011-2013 (Wagley & Jha 2013). These efforts have provided some "policy and strategy for the development and integration of ICT in Education Master Plan" (MOE, p.11). This shows a hope of increasing affordances of schools to ICT for teaching and learning in general. However, a concrete plan and action have been slow compared to the rapid growth of ICT use in daily life of people in Nepal. Also, there is doubt if the government (MOE) can spend enough on ICT when about 90% of total education budget goes to salary and other administrative costs (Wagley & Jha 2013).

Role of Technology

Some scholars critique that the use of technology produces a modest difference in students' performance, but it does not support "a breakthrough." (Cheung & Slavin 2011, p. 20). This case shows that some teachers and researchers are in favor of technology use on specific curriculum areas in our mathematics curriculum rather than in each content area. They prefer to integrate technology with hands-on materials (Kendal & Stacey 2002; Stacey, Kendal & Pierce 2002) noting that it is not clear which procedures are best executed by hand, which with technology and which in an integrated way. Another important issue in technology use is a matter of student interactions with each other, with the teacher and the technology. Further, self-reflection on mathematical content and attitudes has been suggested by Forster and Taylor (2000) as essential for mathematical progress. Geiger, Faragher, Redmond and Lowe (2008) proposed that technology can play a role in the conceptualization of mathematical models that can provoke a change in student–student and student–teacher interactions and has the potential to mediate collaborative approaches to mathematical inquiry (Geiger, Faragher & Goos 2010). The collaborative approach is useful for the conceptualization of mathematics using technology in the context of Nepal provided that the teachers are well trained to use technology and students have an opportunity to use technological tools within schools and outside. When we think of technology in public schools in Nepal, it is difficult to manage it not due to cost, but due to classroom size and number of students in a single class. Also, we have a continuing problem related to the affordability of technology for students to use it in examinations (Pierce & Ball 2009). The role of technology in Nepal has been realized for the rural development (Pun 2012). It has tremendous potential in developing education, health, business, and industries through the introduction of ICT in rural Nepal. However, there is a lack of government policy at micro level and support to the actors who wish to develop ICT in rural Nepal (Bal & Mishra 2012) in general and mathematics education.

We discussed some issues related to philosophy and theory, culture, politics, society, and technology for teaching and learning mathematics in the context of Nepal. These seem to be very complex issues in nature and complicated to resolve at a time. However, we have briefly presented here some measures to address these issues by improving mathematics curriculum and practice of teaching and learning mathematics.

RESOLVING THESE ISSUES

Earlier, we discussed different issues of teaching and learning mathematics in relation to theoretical, social, cultural, political, and technological aspects. Pointing to the problems and challenges could be an easy task whereas providing a feasible solution is a challenge for us. We would like to discuss some practical, pedagogical and curricular measures to resolve these issues in the context of Nepal. We realized that there should be more research studies to understand the nature and gravity of these issues and their impacts in teaching and learning mathematics and their consequences in general in Nepal. The discussion above might give us a glimpse of these issues and it provides some feedback to the teachers, parents, curriculum planners and policy makers about the issues related to mathematics curriculum, emergent practices and pedagogy in the teaching and learning mathematics in the context of Nepal.

Theory-Practice Balance

We think that mathematics teacher education and training curricula in Nepal should include a broad range of theoretical aspects including radical and social constructivism so that the teachers are aware of advantages and disadvantages of these theoretical aspects. Also, they may implement these theories in teaching mathematics based on classroom context and availability of resources. Even they can construct or collect resources if they are aware of these methods. They may use strengths of individual students to manage the class to teach and help each other even in a large classroom. They can design projects for students in which the students may work individually or in peer to study local knowledge of mathematics and bring them into the classroom discussion. A strong theoretical knowledge always helps teachers to design their lessons in a flexible and creative way despite the lack of resources and lack of clarity in the curricula and textbooks. A theoretically strong teacher does not depend on the given resources and curricula, but he or she may invent the resources and integrate content with various contexts for the students to learn mathematics.

We also believe that teachers should be aware of social aspects of teaching and learning mathematics. They should be able to deal with students of all social backgrounds. The teachers should be well trained to act wisely and tactfully in the classroom so that no students feel neglected, racially biased, and mistreated in the classroom by teachers and other students. Social structure in the community and society, in general, may reflect the classroom context, but teachers should always challenge the status quo structure of the society. The social injustice should not be mirrored in the classroom. Social segregation based on language, class, and gender should be a part of classroom practice, but it should be challenged and changed by the schools and teachers in general and mathematics teachers. Social taboos about gender roles, the ethnic disparity in decision-making in social issues, and class hierarchy should not be reflected in the classrooms. Hence, mathematics teachers should be aware of these issues in general and be prepared to tackle them the classrooms. This may not happen all at a time. Teachers need training and support to create socially equitable and just classroom.

Multicultural Education

We discussed many issues in teaching and learning mathematics related to cultures. The diversity of culture might have been considered as a barrier to providing equal access and maintain equity in mathematics classrooms. However, it can be thought of other-way-round. The diversity of cultures from where students come to the classrooms can be a rich source of knowledge, diversity of ideas, and opportunity to learn from each other. The cultural diversity brings knowledge diversity. The curricula that integrate cultural knowledge and practice become a rich source of new insights and practice in mathematics. The monolingual and mono-cultural curricula can be diversified with the multilingual and multicultural classroom. One question may arise and has been a central issue as discussed above – How can a teacher speaking one language and coming from a different culture (than many students) can promote multilingual and multicultural classroom for teaching and learning mathematics? The answer is positive – a teacher who speaks one language different from many students and who belongs to one culture different from many or all students can promote multilingual and multicultural classroom through resilience. He or she can use the classroom itself as a resource. He or she can use the diversity in the community as a resource. He or she can pick one student (in turn) from each cultural or linguistic background and ask them to work with others to help each other in the interpretation of what is taught, and they can collaborate with each other and learn from each other. The teacher can facilitate their discussion within the class and out of class by creating teams of students (community of learners). Teacher motivation is an essential factor in this situation. The schools, communities, and the government should motivate teachers to convert unfavourable situation to use as a resource and turn it into an opportunity to be creative and constructive while teaching and learning mathematics (and other subjects as it may apply to).

Leadership, Policy, and Technology

The issues coming from politics or the issues that are political in nature can be resolved through positive actions of teachers, schools, communities, and the government. The politics power, privilege, gender, race, and identity can be addressed through common understanding and taking responsibility to create a just society. The teachers should be professional to provide their service to the students by creating equitable and just classroom environment. The schools should have policy to train teachers to enhance social justice classes by incorporating multicultural practices in teaching and learning mathematics. The schools should promote equity and fairness within the classroom and school premises where no students feel left behind because of gender, race, power, and political reason. At the same time, the teachers' union should take the responsibility of professional development of teachers and assume the responsibility for equity and social justice to all students. The teachers' union should not only be political wings of political parties, but they should act as professional organizations to protect teachers and develop them professionally through training, education, and resources.

The issues related to technology in teaching and learning mathematics could be resolved only through the adequate use of technology in the classrooms to promote students' understanding of mathematics, not just to demonstrate what happens and not just to calculate. The teachers should be well trained to use the technological tools for teaching different content areas of mathematics. The general knowledge of technology can help teachers to understand the overall applications, but they need specific skills to use them in teaching specific contents. For example, the general knowledge of computer and Internet is not sufficient to teach arithmetic, algebra, geometry, and statistics. Each

content area may need a certain set of skills and certain application of technological tools. Also, the teachers should have access to these technological instruments such as computers, projects, smart boards, and calculators at schools. The schools should be able to acquire them. These tools are costly, and the government should support schools to have these resources.

We realized that having resources does not guarantee their positive impact in teaching and learning mathematics. Therefore, there should be motivation to teachers to use them. The schools and the government should implement the policy to enhance the use of technology for the demonstration of mathematical phenomena that is otherwise not possible, construction of new concepts, solve long and sophisticated problems, and develop a clear understanding of mathematics. The government in Nepal should spend a significant amount of budget to equip all schools with technological tools and train all teachers to use them effectively. This is an enormous task that requires both courage and commitment, but it is not impossible either.

A macro perspective will also need to be balanced by a micro perspective based on school-based research in marginalized, hard-to-reach communities with a suggested focus on three key issues (Furma 2012). First, innovative teaching and teacher development, addressing the practical difficulties facing schools with limited resources; how and to what extent such schools collaborate in the best interests of children in their localities, innovate to improve the quality of teaching and learning, and deploy their resources (financial, material and human) to maximise opportunities for development (Furman 2012). Second, parental and community engagement, addressing how and to what extent schools manage family-centred practices which are both relational (e.g. in terms of effective communication) and participatory (e.g. in terms of active parental involvement in decision making and support of their children's education), and how and to what extent they can capitalise on the support of charities, NGOs and other school benefactors (Furman 2012). And, third, school leadership, addressing how and to what extent school leaders can eliminate social injustice and promote social justice through a 'socially just pedagogy' (Furman 2012 p.197 as cited in Wilson 2014).

We highlighted different issues of teaching and learning mathematics and the idea of resolving them in a practical way. We have suggested different measure in addressing these matters. However, we might not be dealing with these issues wholly, or we may not be able to achieve the goal right away because these are the emergent issues depending on the emergent situations. In our opinion, the depth studies in each of these issues may give more feasible ideas to solve them. We would like to suggest to the government, academic institutions and different stakeholders such as curriculum planners, policy makers, experts, teachers, students and parents to be serious and aware of these issues and their consequence. It needs a collective effort of all to resolve them. A strong commitment, dedication, and desire of all are must to address these problems and improve the quality and equity in mathematics teaching and learning in Nepal.

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