Challenges Encountered by Mathematics Teachers in ICTs Implementation

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ABSTRACT

Information and communication technologies (ICT) have a great deal with teaching and learning processes to conceptualize abstract concepts in mathematics. The objective of this study investigated the challenges encountered by secondary-level mathematics teachers while implementing ICT-based training in a classroom in teaching. We used interpretive inquiry as an approach to research. As the study tools, we used in-depth interviews, observations, and generated textual data. We analyzed the data by adopting the data's sequential coding, categorizing, and thematizing. We used constructivism as a theoretical lens to understand and explore the use of ICTs. We envisaged and generated the themes on challenges that are inadequate ICT-based professional development training and tools; lack of competency in technological/ pedagogical content knowledge; disempowering school actors; enduring 'one size fits for all'; structured curriculum; lack of infrastructure and ICT tools and hegemony of traditional classroom practices. The significance of the use of ICTs has been recognized in public schools in Nepal. There was also evidence that the current practice of ICT-based teacher education and development was not excess in developing skills and knowledge to use ICT in their classroom.

Keywords: ICT Implementation, Teachers' Challenges, Mathematics Teaching

Introduction

The use of Information and Communication Technologies (ICTs) in schools for teaching and learning, particularly in mathematics, has played an important role in understanding simple concepts and abstract ideas (Fathima, 2013; Faggiano & Ferrara, 2017). ICT is a broad concept that refers to the gathering, storage, processing, transfer, and display of information using a combination of hardware, software, and communication. It is used to communicate, modify, and store data digitally. Hence, varieties of ICT tools such as email, internet, SMS, videos, social media, e-learning, multimedia, software, mobile applications, etc., can be used for mathematics teaching and learning.

Therefore, realizing the significance of ICTs throughout the teaching-learning process the state of Nepal has formulated several policies and plans such as the IT Policy

(2010), three Year Plan 2011-2013, ICT Master Plan (2013- 2017), and the latest School Sector Development Plan (SSDP) (2017-2023) for promoting ICT integrated teaching procedures and learning activities Ministry of Education [MoE, 2016). MoE has established ICT lab and internet connectivity for a few model schools. National Center of Education Development (NCED, 2015) also provided ICT integrated pedagogical training to the teachers of schools with ICT connectivity in public secondary and lower secondary schools. In beginning, very few public secondary school teachers were trained in general, including mathematics teachers. Because of the lack of specific pedagogical training on ICT, Prirerya was given general ICT training (researcher participant training observation, 2016) the proper implementation in the classroom still seems challenging (Parajuli, 2017; Rana, 2016; Dahal & Dahal, 2015).

In developed countries, ICT tools have been used for effective teaching and learning activities in mathematics by investment in ICT infrastructure, software, and teacher professional development. Schools are facilitated children with every required ICT service as per the digital natives' wish (Curtis, 2014). However, there is a tremendous challenge in the technological gap between developed and developing countries like Nepal (Giller, 2014). In Nepal, mathematics teachers have been facing several difficulties in implementing ICT-based training in the mathematics classroom as a lack of teachers' competence, a lack of school vision and plan, and disempowering school leaders (Msila, 2015).

As per my experience, there are significant essential aspects while using ICTs in teaching mathematics, such as a shift in technological beliefs, confidence and competency, and engagement in innovative lesions (Wachira & Keengwe, 2011). On the other hand, only available hardware, means of software, and other related tools might not work themselves that teachers need to be well confident, but problems occur and hinder to use of ICT in the mathematics context of Nepal that makes a sound delivery system (Singh & Chan, 2014; Ling et al., 2013)

Hence, the focus of inquiry of this paper is to explore the challenges encountered by secondary-level mathematics teachers while implementing ICT-based training in a mathematics classroom in teaching and learning particularly in the public schools of the Kaski District of Nepal.

Integrated Teaching with ICT

The ICT integration for the pedagogical practices needs to concern the system. According to Rogers (2003), integration of ICT into classroom practices is also the individual decision to do action for something change in the classroom practices. It may possible if the teacher she/ her motivate for growing the profession with appropriate technology-based pedagogies Andoh (2012). However, students also might be used

verities of websites or ICTs tools (Messenger, internet, CD ROMs, videos, mobiles, and laptops), multimedia, and social media for self-learning activities. For this study, we followed the Saltan and Arslan definition of ICT integration by ICT-trained secondary level teachers in the mathematics lessons for classroom teaching and learning activities (Saltan, & Arslan, 2017).

The integration of ICT into the teaching and learning process is complex, expensive, and complicated that have been identified by many researchers. Bingamils(2009) identified problems and challenges in integrating technology for teaching and learning in the classroom, influencing different factors; such as the school's level, teacher's level, and system's level. However, user characteristics, content, technology issues, and capabilities of the organization were recognized by Al-Faki and Hassan (2014) as key aspects influencing the integration of ICT into classroom instruction in general and mathematics instruction in particular.

Key Challenges in Using ICT

Mathevula & Uwizeyimana (2014) and Yang & Leung (2015) argued that teachers' self-efficiency and confidence are key challenges in using ICT in teaching-learning activities. Teachers who don't have general ICT literacy skills such as typing, the internet for searching materials, downloading, email, word processing, etc. are significant predictors. However, teachers who have less interest and are incompetent are less able to increase self-confidence which discourages making decisions (Asabere, Ahmed, 2013). Moreover, Bas et al. (2016), argued that teachers with more experience in technology and more engagement have greater confidence in their perceptions and abilities to use advanced technological tools in the classroom. However, plenty of available time for work and training are also essentials which are argued (Leendertz et al., 2013).

Mishra and Koehler (2006) argued that technology enhances pedagogies. Teachers need appropriate knowledge with a combination of pedagogy and technology to support students in working with specific subject content that proprieties knowledge, competencies, and skills of teachers who received. Those teachers that believe in and use technology for instructional support might have external expectations more than tough teacher-centered (Voogt & McKenney, 2017). Hence Philomina & Amutha (2016) claim that Technological, Pedagogical, and Content Knowledge (TPACK) is essential but not sufficient for teachers to become creative or innovative in their thinking and doing about using technology for intellectual needs" (p. 605).

Therefore, the knowledge of TPACK holds higher value in the technology-enhanced classroom but does not apply to every teacher while using only a single transformation of content or pedagogy or technology (Koehler& Mishara, 2009; Kipsoi et al., 2012). Autonomy, capability, and creativity are also essential to developing teachers' quality

teaching (Bas et al., 2016). Teaching with technology demands TPACK knowledge and proper delivery of the subject matter by teachers in the classroom (Kihoza et al., 2016). However, incorporating technology for meaningful teaching of mathematics seems challenging for many mathematics teachers in the context of Nepal as well (Alayyar et al., 2012; Kihoza et al., 2016)).

In addition, time for training, level of training, and lack of specific resources (Bengimals,2 009) are other challenges in teaching-learning activities. Technology is introduced into teacher training programs, but trainers are often focused on teaching technology instead of teaching with technology (Parajuli, 2017). Hence, inadequate training on a specific subject through sound resource persons might be a significant problem for not being able to implement ICT-based training by the secondary level mathematics teachers in the classroom practices in the context of Nepal (Parajuli, 2017).

One of the key challenges to implementing ICT training in mathematics classrooms for teaching and learning is the lack of ICT infrastructures, unavailability, and accessibility. The available infrastructures also do not work correctly in the classroom, hindering teachers from proper use (Tondeur et al., 2016). Behind that, for proper implementation of ICT, students also need ICT tools to develop their ICT skills and knowledge for preparing assignments, searching materials, and presenting in innovative ways (Simmons & Hawkins, 2010). But due to lack of access to ICT and lack of ICT-enabled school environment, teachers and students have been facing more challenges implementing ICT in mathematics classroom practices.

Etambo et al.(2016), argued that technical challenges are one of the top barriers influencing mathematics teachers while integrating ICT. They argued that absences of technical assistance and good technical support might be disturbances to the smooth classroom activities. Teachers could not be accepted to overcome the obstacles that could discourage using ICT instruments due to fear of failure and breakdowns in work (khan et al., 2012). Andoh stated that lack of technical support and maintenance in time as a result of which there is a greater chance of technical problems (Andoh, 2012, p. 144). These barriers hinder the smooth delivery of mathematics lessons in classroom instruction. Due to these reasons, teachers might be frustrated and hesitant to use ICT in the content (Asabere & Ahmed, 2013). Hence, the availability and accessibility of ICT-based technologies in schools and technical support are needed for the teachers to maintain regular teaching-learning activities in the classroom in mathematics.

Theoretical Referent: Constructivism

According to Wang et al.(2012), constructivism is the process of knowledge construction by actively engaging learners to develop higher-order thinking skills through interaction and conversations with each other (p. 126). It believes that students construct new

knowledge actively based on their current and past experiences (Savasci & Berlin, 2012). Social constructivists argued that knowledge is intersubjectively built through the "social speech, personal speech, and silenced speech" (NCTM, 2000 as cited by Jones & Araje, 2002, p. 9). Students become engaged in finding new knowledge by applying their existing knowledge and real-world experience (Kuter et al., 2012). Learning is a social process; students need to engage in substantive conversations to exchange their ideas. The role of the teacher is to guide students. Mathematics teaching through software promotes child-centered pedagogy (Goos, 2010).

According to Wachira & Keengwe (2011), shifts in the learning paradigm technology support teachers for positive impact as a constructivist approach of teaching rather than lecturers. However, the teacher's role is to encourage and facilitate the development of students' mathematical knowledge, connecting students and the subject. She/he can play a different role in engaging students in creative learning activities and showing their abilities for meaningful learning (Grootenboer & Marshman, 2012). So, this theory supported us to understand and observe the participation of teachers and students in ICT-based mathematics teaching and learning in classroom practices. We used specific theories of constructivism as references from the humanistic perspective in this context. That supported us to see and observe the integration of new technological tools (ICT) and teachers' knowledge to use properly in teaching and learning activities inside the classroom.

Methods and Procedure

For this qualitative study paper, we used the interpretive inquiry approach of research, which allowed us to explore and understand the subjective worldview from participants' perspectives (Hartas, 2010) on the challenges encountered by mathematics teachers in implementing ICTs in their Classrooms. It facilitated the adoption of *an emergent field inquiry* (Taylor, 2018, p. 42) to explore the participants' thick description (Flick, 2009) of the research issue. Further, it allowed capturing their individual life-world experiences in subjective ways (Scotland, 2012) from *the insider* (Taylor, & Medina, 2013, p. 4). So, we engaged meaningfully in the field for an extended period with four ICT-trained secondary mathematics teachers where they had worked. It was understood, and we observed their problems and challenges while implementing ICT training in the mathematics classroom. For this purpose, we selected four ICT-trained teachers based on ICT competence, education degree, experience of teaching through ICT, level of engagement, and facilities of ICT infrastructure to get sufficient information on the area of study (Patton, 1990). In this study, we have adopted in-depth interviews and informal conversations several times with careful and engaged listening to capture the realities (Forsey, 2010) through ongoing story records (Clandinin et al., 2007). We recorded the conserved and maintained field notes simultaneously and translated them into four

different phases of diaries in the Nepali language.

Moreover, we developed each day's field journals based on the field notes, field experiences, and memories and prepared an individual portfolio. After that, we transcribed all Nepali transcription into English medium to establish events, providing coherence to the write-up. Then, produce thick evocative descriptions of personal and interpersonal experiences. I presented the ICT-trained teachers' experiences through storytelling (Ellis et al., 2010).

Result and Discussion

Major Challenges of ICT Use Faced by Teachers in the Mathematics Classrooms

Inadequate ICT-Based Professional Development Training and Tools

I engaged in my research, discussing and observing the phenomena of ICT use in classroom practices, particularly in mathematics at the secondary level. I experienced the world of mathematics teachers and came up with particular insights that they felt inadequate training in technological, pedagogical, and content knowledge. They had insufficient knowledge and skills on ICT integration while delivering the contents, particularly in mathematics classrooms. I thought that the significant challenge in promoting ICT-integrated teaching-learning activities in mathematics classrooms was the lack of practical pedagogical training and technical support. As participants stressed, the government had provided ICT-based training only to very few public-school teachers. Teachers also required in-service training on how to incorporate ICTs into mathematics classroom teaching and learning. Therefore, teacher training programs inadequately prepare to equip them with ICT skills, competencies, and pedagogical practices (Shadreck, 2015; Tondeur et al., 2016).

In this regard, Mr. Processor opined that the insufficient and ineffective training for a short period was a major challenge for its application in a classroom context. He noted that the focused training on both technical and pedagogical application of skills through ICT experts could be worthwhile. Ministry of Education (MoE) is operating an ICT-based teacher's training program that has focused more on the first-time entry group, primarily emphasizing general knowledge and skills that teachers are already familiar with. He said, "I feel this training is just for switching on and off the computer". I don't have special software knowledge and training for an advanced teaching course. I need such training, where there is software to teach the contents with the help of subject experts. I feel difficulty implementing advanced technologies such as smart board, laptops, projectors, and software". But nothing of that sort happened. So, it is not so fruitful (Mr. Processior Interviewed dated, 2015).

From my participants' experiences and my experiences as a researcher and teacher, I realized that successful ICT integration in the mathematics classroom requires teachers

who are technologically competent and well trained. The teachers' practical training plays a vital role in determining the level of the use of technological skills. However, I felt that the ICT-based training provided by Nepal's government to the secondary level mathematics teachers was just for developing digital literacy. Although it was crucial for general knowledge, focusing only on computer literacy is insufficient because effective training may model effective teaching practices with specific subjects (Uslu & Bümen, 2012; Infodev, 2015).

It might be due to the less creative and innovative design of training for the pedagogical practices in general ICT-based training (Khan et al., 2012). However, the trainers and trainees looked motivated and self-directed regarding teaching and learning for the ICT-based pedagogies. They felt the significance of ICT-based pedagogies for promoting meaningful learning. These training activities served as motivating forces to the teachers, developing a positive attitude for using ICT tools in mathematics classrooms. Sufficient training opportunities to use new mathematics software and other digital technologies might support them effectively.

Mr. Monitor agreed that the ICT-trained teachers were less competent in technological pedagogical content knowledge. Another major challenge was employing ICT-integrated teaching-learning activities in mathematics classrooms. Regarding this issue, he shared his experience, "In teacher training programs, trainers focus only on general knowledge and skills of ICT. They do not focus on the pedagogical practices in mathematics-related ICT. I am not doing as effectively because of a lack of good ICT skills and competence. I feel that the students are not so interested in learning if the teacher him/herself is under confusion to transfer good knowledge of mathematics contents through ICT."

Lack of computer competence and adeptness at overcoming obstacles is the most powerful predictor of ICT implementation in classroom teaching. Almekhlafi and Almeqdadi (2010) noted that integrating technology into mathematics teaching requires knowledge of the subject area. Thus, the major challenges for effectively using ICT for specific pedagogical practices were inadequate technological, pedagogical, and content knowledge to integrate ICT in mathematics lessons, as well as a lack of opportunities (Stoilescu, 2014). (Stoilescu, 2014).

Disempowering School Actors

Based on my field experiences, among many challenges of employing ICT in classrooms, disempowering school actors such as principals, teachers, members of the School Management Committee (SMC), and members of the Parent Teacher Association (PTA) were other key challenges to ICT-based pedagogies in mathematics classrooms.

Those school actors were less aware of the significance of ICT integrated mathematics classrooms which may also create difficulty to integrate ICT in the classroom. I sensed

that they were less willing to promote ICT-based pedagogies. They did not promote ICT-based pedagogies in schools. Thus, the less meaningful participation of those key stakeholders had hindered developing their capacity to take initiatives in developing ICT-based pedagogies in schools (Mwalongo, 2011). If they had participated in the initiative actions of ICT-based pedagogies, they could realize the necessity of actions and outcomes (Mejos, 2007) regarding the usage of ICT in mathematics classrooms.

Because of the disempowering school actors of development, the schools have fewer infrastructures with insufficient ICT tools. On the other hand, empowerment and participation are intrinsically linked with technologies. Thus, disempowerment might have hindered their participation in promoting ICT-integrated classroom teaching learning activities.

However, few mathematics teachers used ICT tools such as laptops to show mathematics videos. They also provided e-learning materials from pen drive to their students for self-learning at home. In this condition, teachers were promoting ICT-integrated teaching-learning activities with positive attitudes. However, they lacked sufficient knowledge and skills to implement ICT-based classroom practices. This had challenged the state's strategies of achieving broader goals of maintaining quality education (as envisaged ICT Master Plan 2013-2017). It had also questioned the effective implementation and expansion of ICT in education as stipulated by School Sector Reform Plan (SSRP). In addition, it had challenged the focus of the Ministry of Education (MoE) to develop ICT skilled human resources in schools that could monitor and manage the digital content. However, it seems that very few teachers from community schools had better ICT skills for its application in teaching and learning activities. Very few of them had got sufficient ICT infrastructures such as classrooms, ICT tools, and internet facilities. Only a few of them had got good support from the administration.

Enduring 'One Size Fits For All'

I met in Mr. Monitor's office preparing something to teach 'Probability' today by using a video prepared by the Ministry of Education (MoE). I entered the classroom with Mr. Monitor. The classroom was dusty. He used his laptop and multimedia, borrowed from somewhere. He started to play the video. The classroom remained calm and the students seemed to be attentive. After some minutes of interval, he pause the video and explained the ideas of probability. Some students raised their queries as well. However, some students were doing some other work.

The content in the video was made in another context. The teacher in the video was using local materials as instructional materials for teaching the concepts of 'Probability'. I felt that the ICT integrated pedagogy (video-based) was supportive to demonstrate virtually the use of local materials in the learning process. However, the students could not

experience the activities. On the other hand, this was a kind of activity perpetuating the 'one size fits for all' approach. I argue that this ICT-based pedagogy is again promoting the traditional methods of teaching mathematics. It might have suppressed the people who knew mathematics differently through real-world experiences.

This ICT-based pedagogy was not enough to foster social justice in the classroom. It was likely to promote the "traditional classroom" as a "banking pedagogy". Teachers filled students' minds with something like containers. From the viewpoint of critical pedagogy, banking pedagogy hinders students' thinking and promotes passive absorption of knowledge, and disempowers both teachers and students (Tutaka et al., 2014, p. 67). Freire's banking pedagogy truly matches Nepal's context because the pedagogy of mathematics only focused on abstract, algorithm, and product-oriented learning (Bal & Mishra, 2012). In this method, teaching means only telling in the classroom, which creates high pressure on the students and makes the mathematics classroom monotonous. It is true that output is dependent on the input. Traditional pedagogy is one problem that cannot make mathematics education meaningful.

Replicated video-based mathematics pedagogy denied interactive and participatory teaching and learning activities. There was a lack of balance between individualized instruction and group work to promote the interaction between learners and teachers. In the classroom, there might be different levels of students and other ethnic groups. Stinson, Bidwell, and Powell (2011) stated that in a critical mathematics classroom, the teacher provides group work discussion and equal opportunities for students to share their knowledge, and get positive responses to their voices and opinions. Mathematics teachers must have critical perspectives in order to promote justice and equity in mathematics. However, the use of video in mathematics classrooms was less supportive to promote shared discussion, equity, and equal learning opportunities.

Structured Curriculum

In the process of my field visit, one of the secondary level mathematics teachers, Mr. Keyboard shared, "It is difficult to complete the course at the right time because there are heavy course contents in mathematics and there is a compulsion to prepare students for SEE. This also affects me to use ICT-based teaching in the classes." We feel that our curriculum practice school is highly influenced by Habermas' technical interest. We have been practicing a top-down approach curriculum, which is more of a rational model of curriculum. According to Grundy (1987), the technical interest of a curriculum is designed by certain authorities or institutions to determine the learning objectives, contents, and outcomes. The curriculum focuses on the teacher, unit, and subject. Andoh (2012) identified the traditional education system with rigid structure and limited curricula, etc., and teachers were not agreed to use ICT tools. That might be a barrier for the teachers and schools to decide on implementation. In the book

Principles and Standards for School Mathematics, The National Council of Teachers of Mathematics (NCTM, 2000), mentions one of the six principles is "Technology standard". There, it declares the "practicable curricular standards to build a society with both the capacity to think mathematically and a relevant basis of mathematical skills and knowledge required in every aspect of life" (p.3). According to Schubert (1986), metaphorical images of the curriculum; curriculum as subject matter, discrete tasks and concepts, cultural reproduction, and planned activities are related to technical interests. This approach to teaching pedagogy is a behaviorist approach. All the policies, curriculum designers, institutions, school administrators, and teachers are controlled by rules and time schedules. In this pedagogical perspective, teachers use a more instructional approach. Students don't get the opportunity to explore their perspectives. We felt that such a type of pedagogy killed the students' skills and understanding level.

We believe that the Nepalese mathematics curriculum is much more guided by Habermas' technical interest (Schubert, 1988) in the curriculum as subject matter and discrete task. According to Grundy (1987), the technically informed curriculum is more objective. It is more likely that a document prepared by experts to serve their personal interests is licensed in controlling and manipulating the environment in the mathematics classroom. This aspect of the curriculum has been a key obstacle to promoting meaningful, authentic, and inclusive mathematics education in Nepali schools. Moreover, such a curriculum is lifeless and culturally de-contextualized (Luitel & Taylor, 2007) less serving students' interests.

On the other hand, we believe that the existing curriculum has prevented the development of practical and critical mathematics education in Nepal. According to Tutak et al., (2010) ethnos mathematics, equity, and culturally responsive teaching through ICT based are the three emerging domains related to critical mathematics education, which may be incorporated into the curriculum for inclusive and empowering mathematics education. Thus, "mathematics education should never be separated from culture, and society in order to provide sustainable, and inclusive mathematics in Nepalese schools and universities" (Luitel & Taylor, 2007).

It is time for all to have a comprehensive and open discussion on deconstructing the existing curriculum and developing an authentic curriculum that serves all people of the country. It emphasizes meaningful, authentic, and inclusive mathematics education in Nepal. According to Stinson et al. (2011), the evolving pedagogical practice of mathematics is explicitly connected to social justice issues. But, the mathematics curriculum in Nepal does not incorporate the contents that help students learn mathematics through/ social justice. Although the policy massage is digital technologies can and out to be used to enhance students' mathematics learning, the provision of technology alone does not change enough to bring change. So, revision of teaching

approaches and mathematics curriculum is needed to change as well (Amuko, Miheso, & Ndeuthi, 2015). So, the mathematics curriculum in Nepal also does not incorporate the contents that help students learn mathematics through ICT tools /for social justice. Hence, the curriculum of mathematics is the board challenges to use digital devices to enhance teaching and learning activities in the mathematics classroom (Alqurashi, Gokbel, & Carbonara, 2016).

Lack of Infrastructure and ICT Tools

It might be one day in September 2021; we visited the school (I) and observed everything from the availability of infrastructure for ICT-based classroom teaching-learning activities. It was Mr. Processor's management. We found that the video-based classroom was well decorated with a fixed projector, smart board, laptops, and well sound system. But at that time, when he started his classroom delivery, multimedia and smart boards did not support it. Because of the lack of technical support available in school, technical maintenance was not carried out regularly, resulting in a higher risk of technological breakdowns (Beta, 2004, as cited in Bingamils, 2009, p. 241). It might have created a negative attitude towards integrating ICT into teaching and learning (Ndibalema, 2014) among the learners. He had a technical problem: he could not connect data from the computer to the projector. Later, the problem was solved with a technician's help.

Without good technical support, teachers and whole school resource persons cannot come up with the expected outcome. Hence, getting technical support from resource persons is another major challenge. Technical support helps teachers integrate ICT into the teaching-learning process in the new world of technology (Nkhwalume, 2013). In this regard, Sicilia (2005) highlighted that “technical barriers hinder the smooth delivery of the lesson or the natural flow of the classroom activity” (Bingimals, 2009, p. 241).

Availability of electricity, maintenance, and technical support were challenges for successfully integrating ICT. In addition, Mr. Keyboard felt there were challenges with the electricity supply and the problem of maintenance when the devices stopped functioning. He explained- "In the context of Nepal, there is the problem of load shedding without any managed schedule. When I start to teach through Multimedia PowerPoint, the electricity is cut off. Also, those contents that are very important, we download them online, but due to the problem of load shedding, we can’t show it in front of the students. Due to such seemingly minor technical problems, the class is affected by such a system. Due to such difficulties, teachers do not show any interest in teaching through ICT-based training.

On the other hand, keeping technologies in the condition is a greater challenge. When electronic devices are used for a long time, sometimes they won’t function properly. Due to more expense in their maintenance, they are kept unused because of a lack of

money and technicians. Furthermore, there is a computer teacher in our school but no ICT familiar person. It is difficult for them to connect computer knowledge with the mathematics lesson design."

Classroom infrastructure was not adequate in community schools. The school's infrastructure is one of the key requirements that supports and creates a supportive learning environment for all the heterogeneous students for their physical, mental, and social development. SSRP (2009) intended to make sure that all schools are equipped with minimum enabling conditions that cater to student's diverse needs. It further focused on the school's physical environment including the condition of school buildings, provision of adequate classrooms, and a playground. The physical infrastructures of any school directly affect students learning achievement.

On the other, we understood that most of the students were from a poor economic background and they couldn't have proper access to fulfill the demands of learning materials such as books, copies, etc. ICT tools were beyond their family's capacity so they did not get a proper environment for their self-study at home. Due to their poor family background, they had to learn through the same traditional way of learning. We found that students were less engaged and motivated in ICT-integrated classroom activities. According to Mingaine (2013), computer breakdowns create distractions, and if there is a shortage of technical help, it is probable that routine computer repairs will not be carried out, resulting in teachers not utilizing computers in the classroom. As a result, teachers are discouraged from adopting computers because of fear of equipment failure, because no one will provide them with technical support if a technical problem comes (Joubert, 2013; Nkhwalume, 2013).

The participant also reported the lack of ICT infrastructure (Agyei & Voogt, 2011; Kihoza et al., 2016)) to be a real challenge faced in mathematics classrooms. Schools lacked common mathematical software (such as derive, graphic calculus, geometer's sketchpad GeoGebra software, e-library, etc.) used in teaching mathematics. No classroom was identified to be supported by internet connectivity. According to Kipsoi et al., (2012), the availability of ICT-based infrastructure for teaching and learning is crucial. However, in the Nepali context, the poor situations of ICT infrastructure in school education in terms of number as well as quality are the major barriers to classroom practice. The absence of electricity, lack of suitable computer labs, and lack of accessible skilled persons to run them smoothly are often observed (Mulhim, 2014; Alqurashi et al., 2016). The majority of Nepal's technological infrastructure is under government control. This poor condition situation has an impact on the convenience with which knowledge may be received. In connection with the availability of infrastructure, it makes access to information costly, which in turn hampers the usage of ICTs in the pedagogical approach.

The Hegemony of Traditional Classroom Practices

When we interacted with the mathematics teachers in the schools of my study, we understood that they could not reject traditional teaching-learning activities in mathematics classrooms. Mr. Keyboard expressed that he has become habituated to transmitting ideas of mathematics to the students through chalk and talk approaches. He used fewer collaboration and discussion methods. He oriented the teachers for securing good marks in the examination. The assignment system is also like that of the old teaching method. Due to the traditional way of teaching, there are problems in the proper management of ICT infrastructure by which there won't be effective teaching. However, the teachers who have recently entered the teaching profession are seemingly more positive toward the ICT-based training system. They demonstrate a deep interest in it. The old teachers have a positive impression of it, but they don't have sufficient knowledge and skills in using technology. Teachers come to take the training, but they leave it in the middle of the training without its completion. Teachers have difficulties when it comes to collaborative learning with ICT.

Badia et al., (2013) reported that successfully implementing ICTs on her/ his classroom depends strongly on the staff support, attitudes, and delivery acceptance. If mathematics teachers regard ICT integrated training as neither fulfilling their needs nor their students' needs, it is likely that they will not integrate the technology into their classroom instruction (Badia et al., 2013). Although teachers have attitudes and acceptance towards ICT teaching delivery and the use of technology, lack of attitude to change and belief towards using ICT for teaching will seek to reduce and diminish ICT adoption and integration for teaching mathematics and hence reduce the enhancement of ICT-enabled teaching practices in the secondary schools through ICT (Mathevula & Uwizeyimana, 2014; Philomina & Amutha, 2016). Therefore, teachers' attitudes and their acceptance of ICT for teaching delivery are challenges in the teaching and learning process. On the other hand, perception of usefulness; ability to innovate; expertise; attitudes; beliefs; and feelings for implementation of ICT. Also, personal attributes influence their degree of willingness to accept (Badia, Meneses, & Sigalés, 2013).

But the attitude towards technology and the teacher's knowledge also play a major role in integrating ICT in the classroom. Many contributions have been (Francon, 2016; Yang & Leung, 2015; Leendertz et al., 2013). They agreed that teachers' adoption of constructivist theories about teaching and learning positively impacts the use of ICTs, either directly or indirectly, particularly on how they are used for teaching and learning. According to Wachira and Keengwe (2011), technology can support teachers in developing constructivist-based teaching activities based on shifts in paradigms in education and activities. Meanwhile, teachers need to act as a facilitator rather than lecturers (Schrum & Levin, 2009), such actions hamper students' development of high-order thinking (Shawan, 2014) and conceptual understanding. Teachers must still

require actively participate in a complicated academic subject, such as project-based learning in a collaborative approach (Inan, Lowther, Ross, & Strahl, 2010). It requires knowledge of the content, pedagogy, and various technologies, according to Chai et al. (2013). Learning collaboratively utilizing ICT demands a combination of these aspects, with each knowledge area supporting the others. According to the findings of the first two researches, the reality of teaching and learning does not always conform to collaborative learning theories. However, the findings suggested that technologies might act as agents of change, prompting reflective thinking and cognitive conflict. This outcome opens up interesting prospects for improving teaching and learning toward collaboration ICT practices.

Conclusion

While inquiring about the challenges faced by secondary-level mathematics teachers in implementing ICT training in the classroom for teaching-learning activities, we have understood that incompetency in technology seems to be its major barrier. Effective training for teachers plays a vital role in determining the level of the use of technology skills. The ICT-based training provided by the government of Nepal to secondary-level mathematics teachers is just for developing digital literacy. Although it was crucial for general knowledge, it is not sufficient as effective subject-specific training is a model for effective teaching practices. Moreover, they have insufficient pedagogical knowledge of ICT.

Underpowered school actors such as head teachers, teachers, and School Management Committee (SMC) members were key challenges in integrating ICT-based pedagogies in mathematics classrooms. Those school actors were less aware of the ICT-integrated mathematics classrooms. We felt that they were willing less to promote ICT-based pedagogies. However, we had seen three ICT-trained mathematics teachers using their ICT tools such as laptops and mobile to show mathematics-related videos in the classroom for developing various concepts. They also provided different e-learning materials from pen drives to self-learning materials for students at home. In this condition, teachers were trying to promote ICT-integrated teaching and learning activities with positive attitudes.

In this study, we found that the ICT integrated pedagogy (video-based) demonstrated virtually using local materials in the teaching process. However, students could not experience the activities. This ICT-based pedagogy was again promoting the traditional methods of teaching mathematics denying interactive and participatory teaching and learning activities. On the other hand, it was an activity perpetuating the 'one size fits for all' approach. In addition, a centrally designed curriculum with loaded contents was another challenge for promoting ICT-based pedagogies for mathematics teachers. The

textbook prepared for a year had compelled them to be more structured in teaching-learning activities. The pressure to cover the required contents within the limited timeframe was also a barrier.

We came to the insight that classroom infrastructures were inadequate in community schools. The school's infrastructure is one of the key requirements that supports and creates a supportive learning environment for all heterogeneous students for their physical, mental, and social development. Teachers of secondary schools just started the ICT-based classes without full preparation for ICT-based models and design. It was also seen as just the initiation of ICT-based classes but teachers' reorientation more on the traditional teaching-learning activities.

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