

Challenges of Virtual Learning Environment in Mathematics in the Context of Nepal

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Abstract

The aim of this study was to identify the challenges faced by the learners in virtual learning in mathematics. A qualitative case study was conducted in Mid-western University, Nepal. Altogether ten participants from different districts of Karnali Province were chosen purposively. In-depth interviews and focus group discussions were the tools of data collection. Collected data were transcribed, coded and categorized to develop themes. The method of data analysis is thematic with quotations and block quotes. The study revealed that virtual learning is an opportunity in higher education for job holders and married women as well as others who could not join face to face classes, although it has many challenges. The finding indicates that the learners have faced pedagogical challenges, technological challenges, challenges of time management, environmental challenges and psychological challenges.

Key words: virtual learning environment, mathematics learning, challenges, technology, Nepalese context

Virtual learning environment (VLE) is a technology-based learning environment via internet. Different softwares and technological devices are necessary to conduct virtual learning. It is an alternative way of formal education as well as non-formal education. Dillenbourg (2000) highlights VLE as a social space that

integrates different technologies and multiple teaching approaches. Similarly, Siemens (2004) suggested that the virtual learning situation occurs through network connection as individuals share their interests, knowledge, perspectives, expertise, and opinions through synchronous and asynchronous learning strategies. Likewise, Joseph and Ekemini (2014) stated that the Virtual Learning Environment (VLE) is human-directed with the machine processing process, enabling learners to participate from a distance in both synchronous and asynchronous modes.

After the 1960's, computers had come into practice in different areas and with the rapid development of technology, e-learning has come into the practice since the past two decades (Pappas, 2015). At the beginning of 21st century, technology is rapidly changing and different organizations and learning institutions have started a blended learning approach. According to Pappas (2015), developed countries in the world had practiced ICT integrated approach in learning from the beginning of 2000. After the worldwide terror of Coronavirus (Covid-19), most of the developing countries started online mode of learning from school to university level. Mostly, distance learning through radio and television, online learning via the internet and virtual classes through different software like Zoom, Google meet, Skype and Team has come into practice at the university level as well as school level in Nepal.

In the context of Nepal, Ministry of Education (MoE) launched the Radio education teacher training project in 1978 as the first distance education program. According to Dahal (2014), audio broadcasting started in 1980, which focused on enhancing the professional capabilities of in-service primary teachers with qualifications under the School Education Examination (SEE). Distance Education Centre (DEC) was established under MoE in 1994. The center conducted teacher training and education awareness programs through radio broadcasting (Dahal, 2014). Also, Pangeni (2016) mentions that limited flexibility of higher studies is being expanded by Tribhuvan University and Kathmandu University through open and distance learning. After the establishment of Nepal Open University (NOU) in 2017, postgraduate level has been flexible and accessible in a different discipline through virtual mode.

After the pandemic of Covid-19, more schools and Universities have started a virtual environment in Nepal. Starting virtual mode at the school level is not an easy job, but there is an option to engage the

learners for a long pandemic period. The government of Nepal has started the classes at the school level through Radio and television also. The Government has also requested the stakeholders to conduct virtual mode as the alternative way of teaching at the future school level. In the pandemic period, most school and university level teachers are busy preparing online classes in different subjects

Rationale of the Study

This study aims to identify the challenges that the learners have faced in virtual learning in mathematics in higher education in the context of Nepal. The virtual learning situation in Mathematics is a new and relevant issue in Nepal. Addressing the challenges related to virtual learning will help to mitigate potential threats in the learning process. This study will help the concerned students, teachers, program coordinators, curriculum designers, and all the people interested in e-learning. From my perspective, this study will be beneficial to all university authorities and concerned people in the virtual learning environment.

Purpose of the Study

The main purpose of this study is to explore the challenges faced by the learners regarding the virtual learning environment in Mathematics.

Research Question

1. What are the learners' experiences of learning Mathematics virtually along with the challenges they face?

Delimitations of the Study

This study is limited to the learners' challenges towards the virtual mode of learning mathematics in Mid-western University. As a case study with limited time and resources, I have taken small sample size using purposive sampling strategy. The findings of this study may not be generalized in the programs of other universities as well as the other subjects. I could not conduct an extensive sample survey to identify perception and challenges in a broad area. In my perspective, this study is limited in the experiences of the learners in the case of virtual learning environment in Mathematics.

Literature Review

I have reviewed the theoretical literature as well as empirical studies regarding the virtual mode of learning Mathematics throughout this section.

Theoretical Review

Different theories have been developed regarding online learning. Among them, I have selected connectivism; the theory of George Siemen as the theoretical base of my study. According to Siemens (2004), “Connectivism is the theory of the digital age (p. 3).” Connectivism advocates that learning occurs through network connection as individuals share their interests, knowledge, perspectives, expertise, and opinion in the online or virtual environment. Siemen (2004) also focuses that learning depends on the diversity of opinions and learning is the process of connecting a unique source of information to develop a new concept. Connectivism accepts that learning might be through non-human tools and the capacity of knowing new is more critical. Therefore, I have taken connectivism as the theoretical foundation of my study.

Empirical literatures

The main challenges of online Mathematics learning are the availability of network, lack of contact with teachers and peers, lack of easily manipulative mathematical objects, lack of skill on ICT, lack of proper designing of modules and the lack of administrative support (Gadanidis et al., 2002). Likewise, Durmus (2006) mentions that computer manipulative (virtual manipulative) play an important role to make virtual mode of teaching-learning mathematics more effective. He also emphasizes that virtual manipulation makes the learners more active and engaged. The main challenges that the learners perceived in the virtual mode of learning mathematics were accessibility, availability and the students’ ICT skill. Also the institutions and the instructors need to identify the perceived challenges and opportunities of e-learning and provide practical support (Joseph& Ekemini, 2014). Also, the internet connectivity, personal computing devices and the teachers’ efficiency impacts on virtual learning (Dhakal & Sharma, 2016). Similarly, Gunga (2010) reviewed the challenges of implementing e-learning in Mathematics, Science and Technology Education in African schools. The study indicated that understanding mathematical and scientific concepts is a

challenge in ordinary/traditional pedagogy. It would require a renewed revolutionary approach to implement effective e-learning strategies for math and science in African nations.

In the context of Nepal, Heyjoo et al. (2020) examined the effectiveness of online classes in Nepal in the pandemic period of Covid-19. The authors used a close-ended questionnaire for 23 participants who were engaging in online classes at the university level. The study indicated that the learners used expensive data packs for online classes due to limited availability of technological infrastructures in academic institutions as well as in their homes. Also the researchers suggested that the respective institutions should support the low cost data pack and sufficient training for the teachers to make online classes more effective in Nepalese context. Geographical diversity, technological infrastructure, lack of awareness and attitude, economic condition, lack of readiness and the trained facilitators are the challenges of e-learning in mathematics (Dahal & Dahal, 2015). Similarly, Kunwar et al. (2020) argue that most of the higher education institutions do not have enough preparation for the support to online pedagogy, online resources, digital library, learning requirements and the competencies in present context. Due to the teacher-centered curriculum and traditional lecture method for school to university level, learners remain as passive recipients of knowledge, however, the challenges can be overcome by the combined efforts of the stakeholders (Kunwar et al., 2020). Likewise, e-learning is the most desired, effective and cheaply available tool for the learners because they can acquire more information from the internet. The learners of rural areas were still facing the problem of infrastructures and the internet. However, there is a rapid growing trend of e-learning in higher education in Nepal (Shakya, Sharma, & Thapa, 2018).

Methodology

I have mentioned the philosophical perspectives, research design, population, participants, tools, procedure of data collection and data analysis and interpretation throughout this section. All the terms are described as follows:

Philosophical Perspective

In this study, knowledge is based on subjective perspectives as it is generated through the students' perspectives who are taking a

graduate mathematics course through the virtual learning environment. My epistemological position in this study is accepting multiple realities obtained from the participants' different perspectives. In this study, the reality comes from the emic perspective. I have followed local realities from multiple perspectives of learners. This study accepts subjective reality as it differs according to the different perspectives of the participants. That is real for them what they felt and shared. I believed that every participant in my research has his/her own perceptions, assumptions, feelings, and experiences. Thus, the reality is based on their lived experiences and is not single. I have given equal value to their different feelings and perceptions. I have respected all the views equally because they were equally important to me to complete the study. I did not show the value of my feelings/experiences during the interview and focus group discussion because I had no objective value.

Research Design

I have used case study design in my research because it includes only the virtual learning environment in Mathematics education of Mid-western University. I have conducted this study in a small sample as well as a small group of the population. The findings of this study may not be generalized in other programs and the virtual environment of other universities as well. So, it has been a case of one of the universities of Nepal.

Population and the Participants

The study population were the students doing graduation in Mathematics education in mid-western university, Nepal. There were altogether thirty students in the second batch of graduate level. As a teacher of the population group, I was known to all the population units individually. I also had the contact number, permanent address and email address of each individual. I selected ten participants using a purposive sampling technique from the ten different districts of Karnali province. I had to collect the challenges of the participants on virtual learning. I thought that experiences and the challenges might be affected by geographical area and gender. So, at first, I made a list of the population with their hometown and gender. Among them, I found that some of the study units were from the same geographical area. Therefore, I selected ten participants (eight male and two female) as the representative participants of my study. I have used the

different symbols A, B, C, D, E, F, G, H, I and J to represent the ten participants and requested them to manage time for an in-depth interview and focus group discussions.

Data Collection Tools

As per the purpose of my study, I used an in-depth interview and focus group discussion (FGD) as the data collection tools. I had constructed an interview guideline for the in-depth interview and FGD guideline for conducting focus group discussion. An in-depth interview was conducted through phone, messenger and video call with the participants from different geographical areas. Since I was in contact with all the participants through phone, Facebook, messenger group and email, I did not feel any difficulty while conducting in-depth interviews. I could not conduct face to face FGD due to the lockdown period of data collection and also the participants were in their home town. So, FGD was conducted through online mode using zoom.

Methods of Data Analysis and Interpretation

Analyzing results for a case study tends to be more opinion based than statistical methods. I used in-depth interviews and focus group discussions as the tools of my data collection. I conducted an in-depth interview through direct call and video call using mobile. Similarly, I conducted FGD through online mode using Zoom.

In the in-depth interview, I recorded the call by taking permission of the participants for analysis purposes. I had also noted the important points in my diary in the process of conversation. I listened to the call recordings many times and transcribed the audio recordings to note the required information. The interview was conducted in the Nepali language. After listening to the call recordings many times, I translated the required information in the English language without changing the meaning. After listening to the audios several times carefully, I explored the emerging themes.

In the case of focus group discussions, I recorded the zoom discussions on my personal computer with the participants' permission. After completing the discussions, I watched the video several times to note the required points. Most of the discussions were in the Nepali language but the main points were in English. So, it did not take more time to transcribe data from an interview. Data collected by two different sources were triangulated, coded and

categorized to develop the themes. I tried to identify the differences and similarities within the data between two different sources.

Data Analysis and Interpretation

According to the view of the participants in in-depth interviews and focus group discussions, I have classified the challenges of virtual learning in mathematics as pedagogical challenges, technological challenges, psychological challenges, time management challenges, environmental challenges and the content-based challenges. I have described the different challenges of virtual learning in mathematics expressed by the participants in the following way:

Pedagogical Challenges

Different study reports and the experiences show that virtual mode of learning is useful in higher education than at the school level. Participant 'A' explained that:

We are habitual in face-to-face learning and our course facilitators also are habitual in the same learning culture. Virtual learning needs extra knowledge and skill on ICT, but we and our facilitators are in the beginning stage of ICT. So it has created conflict in our teaching-learning culture. The nature of the course in virtual mode should be practical rather than theoretical. And it has been a challenge to the learners.

He further explained that the curriculum should be flexible and should be offered instead of traditional theoretical courses and the learning environment should also be collaborative. When I raised the issue of pedagogical challenge in FGD, participant 'B' said "There is a lack of harmony in curriculum designing and implementation." The participants' experiences reflect the need for newness in curriculum designing, collaborative approach in learning, group work, harmony in curriculum designing and implementation, practical work in research, flexibility and applied curriculum to make virtual learning more effective.

Technological Challenges

Technological challenge has been the main challenge of virtual learning in Nepalese context. Participant 'C' said, "Irregular electricity supply and inconsistent internet connectivity is

the main problem of virtual learning.” In supporting this challenge, another participant ‘D’ argued that–

The main challenge of virtual learning is slow and irregular internet facilities in the context of Nepal. Irregular electricity is the main problem in remote areas. Alternative resources like solar, inverter, data pack are not easily available and also expensive. Slow connection causes the break in sound and slide share. The slow internet connection disturbs audio and PowerPoint presentations. Irregular electricity supply, inconsistent internet connectivity, and the web portal's slow speed were the main challenges that I faced in virtual learning.

From the participants' real experiences as mentioned above and in my own experience, the technological problem is the main problem faced by the learners in a virtual class. Due to the irregular electricity and unstable internet connection, learners have faced many problems in joining virtual programs, submitting assignments on time, and completing all the assigned activities. Lack of sufficient knowledge on ICT and irregular electricity has been the greatest challenge of virtual classes in the Nepalese context.

Environmental Challenges

In the process of the interview, participant ‘E’ said “Background noise disturbs the virtual class. Sometimes we cannot control it and need to leave the class.” Other participants also shared their experiences on background noise and disturbance. Participant ‘F’ expressed the feeling about the environmental challenge as “Secret rooms and a peaceful environment are compulsory for a virtual class. In the time of family members gathered together at home, managing a peaceful home environment is a great challenge for all; especially for women.” The common view of participants in FGD was that learning from home/room is not disciplined as face to face learning. It is so difficult to control the mind and concentrate on learning in an informal situation. Video sharing is not necessary for the virtual class. Generally, instructors mute all the learners in presentation and learners raise a hand if they want to say anything. Learners can leave class after joining and do other work if they think the presentation is not important.

Psychological Challenges

According to the common view of the participants in FGD, there is a lack of students' motivation in virtual class. Student motivation can only truly happen intrinsically, creating the right online environment where students want to learn and feel successful. The instructor's main responsibility is to motivate the learners and make them confident of success. There is a lack of teacher presence, face-to-face interaction, and teaching support. The most common psychological challenge of an online instructional environment is to sustain enough learner interest or support intrinsic motivation. On the other hand, learners who are new to an online learning environment typically lack the level of awareness, time management skills, and self-directed learning needed to be successful. Participant 'G' shared his view as

The primary role falls on the teacher to anticipate and prevent motivational challenges unique to e-learning. One way this can be done is by increasing face to face interactions through a variety of technological modes. Learners often have anxiety about learning online and need to feel connected, reassured, and safe to contribute in their new learning environments. E-learning environments often lack various communication options, creating an unwelcome online learning atmosphere that only the instructor can control. To help students in anxiety, instructors should provide various alternative ways of interacting and communicating through such applications like chat forums, or discussion boards.

In support, some other participants emphasized that virtual learning makes the learners isolated than in face to face learning. It affects social behavior and face to face interaction on social issues. Face to face interactions with friends helps the learners to learn concepts and behaviors. It also helps to develop social adjustments. Learners cannot get such opportunities in virtual learning. From learners' experiences and the researcher's own experience, virtual learning increases isolation and affects the ability to participate in social activities.

These opinions indicate the lack of student motivation and social interaction in virtual learning. The common view was that the facilitator should help the learners individually in their problems and make them confident that they can do so. Different methods of interaction should be applied to increase interpersonal communication.

Challenge of Time Management

One of the participant shared his experience regarding the time management in higher education as “workload is necessary and compulsion to earn for the family but it created difficulty in time management in learning. It is not easy to continue higher education for job holders and guardians of children.”

From the participants' real experiences, I concluded that time management is one of the great challenges of jobholders in virtual learning. In my own experience and the participants' viewpoints, most of the mathematics teachers who have completed undergraduate level take classes from morning to evening in different schools and tuition centers also. Due to the large number of classes of different levels they become tired in the evening.

Content-based Challenges

Virtual class on mathematics is different from other theoretical subjects. The numerical solution, drawing chart, table, pictures and long steps of solutions with complex symbols are not easy to type. When I asked about the challenges of mathematical content in the virtual process, participant ‘J’ stated

I felt more difficulty in the solution of Numerical problems. Instructors also can not present all the steps of long numerical problems in the slide. Learners could not show the teachers to address the mistake and correct it immediately. It is not an easy job to type all numerical steps in a short time and show the teachers. Sometimes the learners solve a on [notebook] and send an image to the teachers. The images of the solution may or may not be clear and the teachers find it difficult to check out images and identify mistakes. A long numerical problem may have more images and if the series of images could not be managed, the solution becomes zigzag. This process is difficult in the virtual class of Mathematics.

In the process of FGD, all the participants shared their different experiences on the solution of the numerical problem through virtual mode. Participant B stated

Some of the problems of mathematics are pictorial, graphical and need the table. Creating graphs, pictures, and tables takes more time. It is difficult to show in powerpoint because power point breaks the long tables, pictures and figures that create difficulty in understanding.

He further explained that long steps of numerical problems with complex operators and symbols are difficult to type and make slides. So the learners should do in [notebook] and it is difficult to show teachers immediately. Other participants also supported him and said that instructors expect an e-copy of the solution rather than images of handwriting because the handwriting image may not be clear and may not be in chronology. It is the problem of virtual classes in mathematics.

Findings and the Discussion

This study examined the challenges faced by the learners in virtual mode of mathematics learning. The challenges expressed by the learners are classified into six major themes as pedagogical challenges, technological challenges, psychological challenges, the challenge of time management, environmental challenges and the content - based challenges. In the discussion of the pedagogical challenge, most participants said that the curriculum of virtual learning should be different from the traditional curriculum. The practice-based and applied curriculum should be designed to implement virtual learning. They shared their feelings about the need for newness in curriculum designing, collaborative approach in learning, group work, harmony in curriculum designing and implementation, practical work in research, flexibility and applied curriculum. Bringula et al. (2021) also identified the challenges faced by the learners in mathematics online learning as intermittent internet connection, power interruption, learners personal challenges, domestic challenges, pedagogical challenges, assessment challenges, consultation and anxiety. They said “technological challenges are the most pressing concern in online learning” (p.13). Likewise, Irfan et al. (2020) pointed out that lack of proper knowledge and skill in online platforms, availability and accessibility of mathematical software and the limitations of writing mathematical symbols are the main challenges of mathematics learning through online mode.

The content-based challenge was another challenge of mathematics learners. All the participants interviewed and participated in FGD told that virtual classes on pure mathematical contents and long numerical problems are more challenging than theoretical classes. According to them, slide shows in numerical problems are not effective as direct solutions. Most of the learners want to solve the numerical problems with teachers together but it is

not possible in virtual class. They said that submission of assignment on numerical content is more difficult than theoretical because it takes more time to type. Image of handwriting may or may not be clear. So the learners had shared different problems on mathematical contents through virtual mode. In an investigation of learners' experiences of online mathematics learning in Zambia, Mukuka et al. (2021) reported that more than 56% of the respondents do not have sufficient access to ICT and internet service. They also focus that most of the learners take mathematics as a subject that is best learned with face to face interaction between teachers and the students. The attitude of learners towards mathematics impacts learning mathematics through online mode. Similarly, Kunwar et al. (2020) argue that most of the higher education institutions in Nepal do not have enough preparation for the support to online pedagogy, online resources, digital library, learning requirements and the competencies in present context. However the challenges can be overcome by combined efforts of the stakeholders.

Conclusion

The main purpose of the study was to find the learners' difficulties or challenges of the virtual learning environment in Mathematics. A qualitative case study based on interpretive research design was conducted. In-depth interviews and focus group discussions were used as the tools of data collection. The experiences of the participants were discussed and interpreted on the basis of thematic analysis. The study revealed the learners' experiences as a shift to the new learning models which can be accessible and affordable from the remote. The virtual learning environment has been observed as the paradigm shift to uncover contemporary thoughts with the response to technological immersion and the maintenance of soft skills in teaching-learning context in Nepal. The study revealed the challenges in the implementation phase of the virtual learning environment in mathematics in higher education. The challenges associated with virtual learning were; psychological, pedagogical, technological, physical, lack of sufficient knowledge on ICT and other socio-cultural factors. Similarly, challenges were also associated with the learners and the situation they had in terms of installing cyberspace for virtual learning. On the other hand, time management for assignments and recommended presentations and project works were also challenging for the job holders and those who remain busy in household works. As per the nature of the subject

matter of the Mathematics symbols, operators and the procedures were considered as the challenges. In my perspective, this study would be equally beneficial to the policy makers, curriculum designers, university authorities, teachers, and students and all of the stakeholders for the need to be conscious and responsible for minimizing the challenges of virtual learning in Mathematics for its effective implementation.

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