

# Perception of Learners on Virtual Learning Environment in Mathematics in Nepali Context

Prem Kumari Dhakal<sup>1</sup>, Bishnu Khanal<sup>2</sup>

[premkumari.dhakal@mu.edu.np](mailto:premkumari.dhakal@mu.edu.np), [bkhanal1974@gmail.com](mailto:bkhanal1974@gmail.com)

<sup>1</sup>PhD Scholar, Graduate School of Education, Tribhuvan University, NEPAL

<sup>2</sup>Tribhuvan University, NEPAL

## Abstract

*This paper aims to identify the perception of learners of virtual learning environments in Mathematics at the university level in the context of Nepal. Mid-West University was the study site. This is a qualitative case study design. All the students who were studying Mathematics in different semesters of graduate and undergraduate level in the year 2021 of faculty of education were the population of this study. Ten students were selected as participants using purposive sampling to represent the different ten districts of Karnali Province. In-depth interview was used as the tool for data collection. The interview was conducted using guidelines through phone and online calls using mobile. The interview was recorded in my mobile device, and the points were noted in my notebook as well. All the collected information was transcribed, translated, and categorized to developed themes and analyzed in a descriptive manner. The result indicates that learners perceive virtual learning in higher-level Mathematics as a necessity and an opportunity. Moreover, the participants said that virtual learning is a useful learning process, and it is better than face-to-face mode because it develops knowledge as well as skill, it also develops the habit of searching for resources, increases self-confidence and independence, it provides permanent learning, saves expenditure and provides an opportunity to earn. Similarly, virtual classes can be continued in strikes and other difficulties like lockdowns, and experienced and busy professors can take classes in their leisure time, even for those with disabilities.*

## 1. Introduction

Virtual learning is a technology-based instructional method that enables learners to participate in learning from a distance in synchronous or asynchronous modes. In another sense, it is a web-based teaching-learning platform to ensure all sorts of teaching-learning components. Virtual learning platforms allow content management, curriculum mapping and planning, learners' engagement and administration, communication and collaboration, and real-time communication.

During the change of time, we normally get changes in the pedagogy of teaching and learning mathematics in higher education. Without the use of recent development, we get a lack of completing tasks. Technology innovation is directly related to societal transformation as we find the change or modification of social framework. It is the change in attitude, behaviors, and activities connected with cultural and economic values. According to [9], computers and other technological innovations influence our lives largely all the time. It is believed that the development of computer technology is a paradigm in the field of teaching and learning and is regarded as technological innovation. We use computers or other digital devices to gain educational objectives determined by the specific learning environment.

Virtual learning is a procedure of personal renovation of content, which is carried out in the purpose of and grounded on the reasoning structure of learning. The elements that make up this structure are basic cognitive skills, specific knowledge of an area, learning strategies, metacognitive abilities and self-regulation, affective and motivational factors, goals and expectations. The situation deals with classroom behaviors and another essence of learning variables as the established values of classroom learning. This demands constant updating of subjects related to virtual learning to incorporate them during the design of VLEs [4].

Looking back into the history of Nepali Education system, the College of Education started an adult education program through the radio in 1958. It is considered to have been the first initiative towards distance education in Nepal. Another important initiative was the launching of a radio education teacher training project in 1978 by the Ministry of Education (MoE) with technical and financial support from USAID. The project started radio broadcasting since 1980 and was focused on enhancing the professional capabilities of in-service primary teachers having qualifications under the School Leaving Certificate (SLC). Likewise, as provisioned in the National Education Commission 1993, the Distance Education Centre (DEC) was established under MoE in 1994. The center conducted teacher training and education awareness programs through radio broadcasting. After the unification of DEC with the National Centre for Education Development (NCED) in 2005, professional development training courses for primary to secondary level teachers, SLC support, and radio programs on education information are being conducted. Policy and directives to regulate open education and distance learning in Nepal are Open Education and Distance Learning Policy 2007 and Directives on Distance Education/Open Learning Program 2007 with its third amendment 2014. Formulating policies and other documentation on distance education and open learning programs is supportive of establishing open schools and formalizing distance learning programs [2].

Some popular approaches to offer flexible learning are online or distance study. Other examples of flexible learning options are opportunities for learning from work and employer engagement, part-time study, web-based or blended learning, time-driven programs at students' pace, contact sessions, workshops, and seminars. In the Nepali context, some of these options are available to a limited number of programs of higher studies at two leading universities: Tribhuvan University (TU) and Kathmandu University (KU). TU offers ODL for bachelor and master programs and KU offers ODL for master programs. These ODL programs from both universities are for teacher education. Students at the secondary level also have distance learning options for SLC. Besides that, some schools, colleges, and universities also offer flexibility in schedule: evening, day or morning classes. Students working full-time during the day can join morning or evening classes. For the students in the Himalaya regions, there is a provision of Mobile Schools. Such schools shift their location seasonally (winter and summer) as people living in the Himalaya region move their places of residence [6].

Nowadays, all Nepali students connected to the Internet have equal opportunity to choose a variety of formal and non-formal or flexible learning. They can pick any course of their choice from the University of their Dreams that exists anywhere in the world. In addition, Nepali students have limited options to get an education with flexible options at domestic institutions. Starting from the secondary level to the tertiary level which includes initiatives of open schools and ODL at HEIs. The limited flexibility of higher studies is being expanded because every year new courses and programs are offered by TU and KU through ODL. Since 2012, the Open University Infrastructure Development Board has been working to establish Open University in Nepal. As a result, Nepal Open University (NOU) was established in 2017 to provide higher education on Bachelors', Masters' and M. Phil levels through a virtual learning environment.

Mid-Western University (MWU) was established in 2010 as the regional University in Nepal. It has launched all its programs through a face-to-face mode of learning. In the pandemic situation of Covid-19, more teachers have been taking classes through virtual mode. Department of Mathematics Education, Faculty of Education has been conducting virtual classes on graduate and undergraduate levels. As the current issue of the new learning paradigm, the researcher became interested in identifying learners' perceptions of virtual learning modes. More studies have been conducted on the perception and challenges of virtual learning that are expressed in the literature review session. It is a new and relevant problem to discover learners' perceptions of virtual learning

in higher education mathematics in Karnali Province. Guided by the question—how do the students perceive virtual learning environment in higher level Mathematics learning? Thus, this study aims to identify learners' perception in a virtual learning environment in higher level Mathematics learning.

The study 'Perception of Learners on Virtual Learning in Higher Mathematics' is a case study at Mid-Western University. Mid-Western University, established in 2010 in Nepal, has launched all of its programs through face-to-face mode and it has aimed to launch a year B.Ed. and one-year M.Ed. program through virtual mode. During the pandemic period of COVID-19, mathematics teachers at MWU conducted virtual classes on Mathematics. As the teacher of Mathematics Education at MWU, the researcher is concerned about this issue. This study will be helpful to the concerned students, teachers, program coordinators, curriculum designers, and all the people who are interested in e-learning. This study aims to identify the perceptions of learners on virtual learning in higher education Mathematics. So, from the view of the researcher, this study will be beneficial to MWU and all the other university authorities and concerned people in the virtual learning environment.

## **2. Literature Review**

In virtual learning environments must be spaces for coaching and producing mastering which can be pedagogically modeled and incorporated with numerous components including technological platforms, activities, and fabric, which all aim to generate knowledge [8]. In flip, the interplay of the community with the aid of manner of technological gear enriches the exceptional of gaining knowledge of the concerned subject matter. [7] states that virtual learning is a system of private reconstruction of a content material that is executed in the characteristic of and based at the cognitive shape of gaining knowledge among the elements that make up this shape are simple cognitive capabilities, specific information of a place, learning strategies, meta-cognitive talents and self-regulation, affective and motivational elements desires, and expectancies. All those factors and how a student utilizes them can cause satisfactory mastering". The changed paradigm is represented through virtual receiving. This is why teachers, directors, technical and help bodies of workers, as well as the institution itself, discover themselves faced with a new and one-of-a-kind shape of learning management system.

As mentioned in [4], Coaching-gaining knowledge is not a closed domain including a lecture room, to paint for various kinds of college students, the improvement of VLE calls for an attempt to migrate from a closed system to a new reality. This demands constant up-courting of topics that get related to virtual gaining knowledge off or you to contain them at some point in the design of VLE. [1] developed a framework for virtual internalization and as indicated in the study digitalization, collaboration, and virtual learning situations were explored in the international dimension. The virtual mode was found as an alternative to the other modes as it is not affected by any boundaries and the interested learners could join from a distance and they can use the Learning management system as prescribed. Seeing the motive of transnational studies, I like to develop this problem in the context of Nepal, which is not covered in the studies that have already done [3] researched 'Virtual Learning Environment (VLE) in Mathematics Education'. The study found that the major opportunities that VLE contributed in F2F classes were to improve study habits, make study more active, and provide the opportunity to learn, re-learn and clarify the concepts. This implies that the F2F courses need to be designed to integrate VLE in an appropriate way.

## **3. Methodology**

Methodology refers to the overall procedure of research. It includes the research design, study site and population, method of sampling, data collection tools and procedure, and data analysis and interpretation method. Following [2], the methodology provides a guideline to develop strategy, plan of action, process or design lying behind the choices. The methodology of this research paper is described as follows:

### **3.1. Study Design**

The design of the study is a case study. This is the case of the virtual learning context in the mathematics group of Mid-West University. The Case study, through predominately a qualitative study design, is also prevalent in quantitative research. [5] says a case could be an individual, a group, a community, an instance, an episode, an event, a subgroup of a population, a town, or a city. Through predominately a qualitative study design, the case study is also prevalent in quantitative research. To be called a case study, treating the total study population as one entity is important. A flexible and open-ended technique of data collection and analysis characterizes a case study. The advantage of the case study design is that the research can be much more detailed, but the disadvantage is that it is difficult to generalize the findings.

### **3.2. Study Site**

Mid-West University is the study site. As a teacher at MU, the researcher thought it easy to collect primary data from students at MU. As a personal study in a short period, the researcher could not include other universities of Nepal that have launched virtual learning in higher education.

### **3.3. Population, Sample Size, and Strategy**

The population of the study is the students studying Mathematics as a major at undergraduate and graduate level in Mid- West University. The researcher knows about all the units of the population. The total number of students is about fifty-two. Ten of them have been selected using purposive sampling to represent the different ten districts of Karnali province. I have used the symbol/pseudonyms S, D, J, S, R, K, H, J, M, and D<sub>1</sub> to indicate the participants from Surkhet, Dailekh, Jajarkot, Salyan, Rukum, Kalikot, Humla, Jumla, Mugu and Dolpa respectively.

### **3.4. Study Tools**

As per the purpose of the study, I have used interview guidelines. In-depth interview was conducted through phone and online call with the participants from each district of Karnali province of Nepal. As a teacher at MU, I was in contact with all the participants through phone, email, and Facebook groups.

### **3.5. Data Collection Procedure**

I have used the following procedure to collect the data from the respondents—at first, I built the rapport and clarified the research problem to the respondents. Then I formed an interview guideline for in-depth interviews and conducted interviews with ten participants from different districts of Karnali province through phone and online calls using mobile. At last, I thanked the participants and said goodbye. The responses were collected and noted in my diary. Also, the audio was recorded with the permission of the participants.

### **3. 6. Data Analysis and Interpretation**

Data was collected through in-depth interviews. I recorded the call by getting permission from the participants for analysis purposes. I also noted the important points in my diary in the process of conversation. I often listened to the call recording and *transcribed* the audio recordings to note the required information. The interview was conducted in Nepali language. After listening to the call recording many times, I *translated* the required information into the English language without changing the meaning. I translated most of the interviews and further conversations into English. After listening to the audio several times carefully, I explored the emerging themes. The non-formal discussion and interview helped me to identify the perceptions of learners in virtual learning in higher mathematics. I categorized the perceptions of the participants to develop a theme and analyzed them critically and thematically.

### **3.7 Ethical Consideration**

Ethics are the moral principles a person must follow, regardless of place or time. Behaving ethically involves doing the right thing at the right time. Research ethics focuses on the moral principles that researchers must follow in their respective fields of research. I have spent sufficient time to build a good rapport with the participants. I have made the participants confident about privacy and have not compelled them to participate in my study.

## **4. Analysis and Discussion**

The learners who participated in the interview talked about the usefulness of virtual learning in Mathematics in higher education. They explained that the learners can read from their own home /room and physical attendance in class is unnecessary. On the basis of the participants' view, I developed the following themes regarding the perception of learners on the virtual learning environment in Mathematics in the university level:

### **4.1. Useful Learning Procedure and an Opportunity**

The participants of this study perceived the virtual learning environment as an opportunity for higher education in the context of Nepal because most of the job holders and housewives cannot attend college regularly in physical mode. The participant K said:

*Continuing higher education in face-to-face mode is not an easy job in the context of Nepal. Most of the students from remote areas and poor economic backgrounds should start work to fulfill the needs of family before higher education. It has been a compulsion and a trend of Nepalese youth. In this situation, virtual mode in higher education has been useful and a great opportunity for learners like me.* He went on to explain that interested learners who are unable to attend the class physically due to his/her own physical problems can continue higher education easily in virtual mode.

All the participants in an in-depth interview said that virtual learning is a useful learning process. It is useful in the sense that the learners can read in their own home /room. Physically attendance in class is not needed. All the interested learners in remote areas can join class in their own home/workplace. Interested learners who are unable to attend the class physically due to his/her own problems can continue higher education easily.

On the other hand, there is a trend of early marriage in Nepalese girls. One female student (D) said, *the childbearing female also can continue higher education in virtual mode. So online mode has become a golden chance for them to continue higher education in their own home with babies.* The virtual mode in higher education is useful not only for job holders and childbearing females, it is equally useful to physically disabled students. After talking about the usefulness of virtual learning, I asked the following question to the participants: *“In what ways virtual learning situation is regarding better than face-to-face learning?”* All the participants expressed that virtual mode is better than face-to-face mode in higher Mathematics. They shared their different feelings in the Nepali language. I translated the views, categorized them, and developed the following different themes.

#### **4.2. Develop Knowledge and Skill**

The experience of learners in virtual mode is that it develops skills as well as knowledge. Learners should be updated in online resources and procedures. Online application, online admission procedure, online registration form, online exam form, and online assessment, are the main aspects of virtual learning. These aspects provide computer skills that are needed in every field of life in this modern era. Without proper knowledge of computers and technology, no one can become successful in a profession like as academic field, banking, business, bureaucracy, or any other. Participant H shared his feelings as *Virtual learning develops the habit of searching resources and ICT skills as well as the English language.*

The habit of searching for resources makes the learners active and engaged in learning. Without the activeness of learners and searching habits, virtual learning is impossible. Students do not expect knowledge from teachers/ facilitators as in face-to-face classes. So, the virtual mode develops the habit of searching for resources according to the common view of the participants.

#### **4.3. Increases Self-confidence and Independency**

The habit of searching for resources, checking authentication, and choosing the best materials develops self-confidence and independence. Course facilitators provide instructions as needed and the learners are concerned with e-library, websites, and other links to find the required materials. Participants shared that the virtual mode of learning mathematics developed their independence and confidence more than before. Almost all the participants advocated increasing self-confidence and independence from online learning rather than traditional face-to-face learning.

#### **4.4. Provides Permanent Learning**

The knowledge obtained from doing is more permanent than listening. Virtual learning motivates students to search and do themselves. All the participants expressed that virtual learning is the best option for permanent learning. Participant J focused on *“knowledge obtained from doing is more permanent than listening.”*

According to the view of the participants, teachers provide sufficient learning materials to the learners and the learners do the work as instruction. Learners get feedback and correct their mistakes themselves. Identifying mistakes and correcting them as needed makes permanent learning and decreases errors.

#### **4.5. Virtual Learning Saves Expenditures and Provides Opportunity to Earn**

Virtual learning saves the amount of rent, food expenditure, transportation cost, and other costs of students for face-to-face learning. Learners need not leave home and need not leave jobs/work. So, it saves money and provides an opportunity to earn. Learners can read the materials in their leisure time. Participant R said, *we need not leave home and job/work to learn. We can do the work to earn in the daytime and read in our leisure time. Teachers upload recorded videos of class in Google Classroom so that the students can learn in offline mode and in leisure time.*

Learners can do work of earning in the day and they can read in leisure time. As the view of the participants, teachers upload recorded videos of class in Google Classroom or face Facebook group, or messenger groups so that the students can learn in offline mode and in their leisure time.

#### **4. 6. Virtual Classes can be Continued in Strikes and Other Difficulties like as Lockdown**

From the view of participants, virtual class is the best option in the context of Nepal. Due to different issues strikes, lockdowns and other obstacles arise in face-to-face learning, but these obstacles do not affect the virtual classes. No unfavorable situation affects virtual classes and can be continued even on holidays and festivals.

#### **4.7. Experienced and busy Professors can take Classes in their Leisure time and even in those Disabilities**

According to the participants, virtual classes are possible in leisure time. There is a lack of efficient and experienced professors of Mathematics in higher education in Nepal. Some professors of Mathematics are busy and cannot take more classes in regular face-to-face mode. So virtual classes are possible at the time they want. Retired professors who are skilled in technology can take virtual classes from their own homes. They can continue virtual classes in the situation of physical disabilities and other difficulties.

The above opinions indicate that the learners perceived the virtual process as essential in higher education mathematics. The participants expressed the need for and importance of virtual learning in higher mathematics in the Nepalese context. I found the common theme about the perception of learners on virtual learning that virtual learning in mathematics in higher education is the necessity of jobholders and childbearing female students in Nepal. In the same way, most of the mathematics teachers at the school level cannot continue higher education due to their jobs. The government of Nepal has implied SSRP but due to the lack of qualified Mathematics teachers, applied mathematics could not be compulsory in classes 11 and 12. It is also the result of the success percentage in Mathematics at SEE level. According to the view of the participants, virtual learning in Mathematics in higher education is needed.

#### **4. 8. Virtual Mode is Difficult in Solving Long Numerical Problems in Mathematics**

Virtual classes in Mathematics are more challenging than other theoretical subjects. Participants said that they felt more difficulty in solving numerical problems. Teachers also cannot present all the steps of long numerical problems in slides. They give only the instruction to solve. Learners could not show the teachers how to find the mistake and correct it immediately. Participant S emphasized numerical problems and said, *I have sent the image of my handwriting three times in numerical contents. Images were not clear at first, in the second time I could not manage the serial. So, I sent it again after managing all.* It is not easy to type all numerical steps quickly and show the teachers.

Sometimes the learners solve by copying and sending images to the teachers. The image 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 serial of images could not be managed, the solution becomes zigzag. This process is difficult in a virtual class of Mathematics class. Participant D<sub>1</sub> shared his experiences by showing the following example on the difficulty of solving long numerical problems step by step in a virtual mode of learning as follows:

**Qu.** Find the curvature and torsion of the curve  $x = a \cos(t)$ ,  $y = a \sin(t)$ ,  $z = a t \cot(\alpha)$ .

Solution: Position vector  $r = (x, y, z) = (a \cos(t), a \sin(t), a t \cot(\alpha))$

First derivative  $\dot{r} = (-a \sin(t), a \cos(t), a \cot \alpha)$

Second derivative  $\ddot{r} = (-a \cos(t), -a \sin(t), 0)$

Third derivative  $\dddot{r} = (a \sin(t), a \cos(t), 0)$

Now, the curvature ( $\kappa$ ) =  $\frac{|\dot{r} \times \ddot{r}|}{|\dot{r}|^3}$  and torsion ( $\tau$ ) =  $\frac{[\dot{r} \ddot{r} \dddot{r}]}{|\dot{r} \times \ddot{r}|^2}$

D<sub>1</sub> said, "I feel that it is so difficult to solve such problems in an online class because I cannot type easily, and I do not have sufficient knowledge and skills in using a mathematical software package." Other participants also emphasized this issue and said that scalar triple product and cross product of vectors takes more symbolic steps, and it is not easy to solve and show the e-copy immediately to our teachers.

#### 4. 9. Difficulty in Solving Problems with Multiple Tables, Pictures, and Diagrams

According to the participants, long steps of numerical problems with complex operators and symbols are difficult to type and make slides. The participant H stated:

*Some of the problems of mathematics are pictorial, and graphical, and need a table. Creating graphs, pictures, and tables takes more time and it is difficult to show in PowerPoint. Sometimes, PowerPoint breaks the long tables, pictures, and figures, creating difficulty in understanding. He gave the following example:*

**Qu.** Maximize  $z = 8x_1 + 10x_2 + 7x_3$  subject to  $x_1 + 3x_2 + 2x_3 \leq 10$ ,  $x_1 + 5x_2 + x_3 \leq 8$  and  $x_1, x_2, x_3 \geq 0$

Solution: Let  $s_1$  and  $s_2$  be slack variables. The standard form of the above system is:

Maximize  $z = 8x_1 + 10x_2 + 7x_3$  subject to  $x_1 + 3x_2 + 2x_3 + s_1 = 10$ ,  $x_1 + 5x_2 + x_3 + s_2 = 8$   
 $x_1, x_2, x_3, s_1, s_2 \geq 0$

**Step 1: Setting up the tableau.**

$x_1$	$x_2$	$x_3$	$s_1$	$s_2$	$z$	c
1	3	3	1	0	0	10
1	5	1	0	1	0	8
-8	-10	-7	0	0	0	1



Based on the participants' view, the above types of problems with long steps and more tables are difficult to teach and learn in online classes. The learners should do the numerical solution in copy, and it is difficult type to but the teachers like e-copy of solutions than images of handwriting because the image of handwriting may not be clear and may not be in serial. It is the problem of virtual classes in Mathematics.

## 5. Conclusion

Virtual learning is a technology-based pedagogy applicable to children and adults in the modern era [11]. It is a widely used approach in developed countries. Developing countries like Nepal have also practiced it in higher education. It has come into practice more in the pandemic period at the school level. There are more advantages of virtual learning with some challenges.

This study was done to identify the perception of learners on virtual learning in mathematics at a higher level. Ten participants were selected using purposive sampling from different districts of Karnali Province. An in-depth interview was the tool to collect data. Collected rough data were transcribed, translated, coded, categorized, and developed themes. From the study, it can be concluded that the learners perceive virtual learning in higher mathematics as a necessity and an opportunity. Moreover, the participants said that virtual learning is a useful learning process, and it is better than face-to-face mode because, it develops knowledge as well as skill, develops the habit of searching for resources, increases self-confidence and independence, provides permanent learning, saves expenditure, and provide opportunity to earn. Similarly, virtual classes can be continued during strikes and other difficulties like lockdowns and experienced and busy professors can take classes in their leisure time even with disabilities.

Hence, virtual learning in higher mathematics is a useful learning process and an opportunity. However, teaching long numerical problems through virtual mode is not as easy as theoretical content. Mathematics teachers should be updated and well-known in mathematical software and alternative tools to teach long numerical problems easily through virtual mode.

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