ATTITUDES OF TEACHERS AND STUDNETS ON USING ONLINE TOOLS IN TEACHING AND LEARNING MATHEMATICS

A THESIS

BY

SURESH ARYAL

IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE MASTER'S DEGREE IN EDUCATION

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शिक्षा शास्त्र केन्द्रीय विभाग
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Date: .....

Letter of Certification

This is to certify that Suresh Aryal a student of academic year 2072 / 073 with campus Roll No. 360, Exam Roll No. 7228408, thesis number 1579 and T.U. Regd. No. 9-2-375-247-2009 has completed his thesis under supervision of Mr. Krishna Prasad Adhikari during the period prescribed by the rules and regulations of Tribhuvan University, Nepal. The thesis entitled "Attitudes of teachers and students on using online tools in teaching and learning mathematics" has been prepared based on results of his investigation. I, here by recommend and forward that his thesis be submitted for evaluation as the partial requirements to the degree of Master of Mathematics Education.

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Prof. Dr. Bed Raj Acharya

HOD

Date: .....

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LETTER OF APPROVAL

A

Thesis

By

Suresh Aryal

This thesis entitled **"Attitudes of teachers and students on using online tools in teaching and learning mathematics"** has been approved in partial fulfillment of the requirement for the Degree of Master of Education.

Committee of the Viva - Voce	**Signature**
Prof. Dr. Bed Raj Acharya	.....
(Chairman)	
Assoc. Prof. Laxmi Narayan Yadav	.....
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Mr. Krishna Prasad Adhikari	.....
(Supervisor)	

Date: 6 March, 2022

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Date: .....

Recommendation for Acceptance

This is to certify that **Mr. Suresh Aryal,** has completed his thesis entitled on **"Attitudes of teachers and students on using online tools in teaching and learning mathematics"** under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva - voce.

.....

Mr. Krishna Prasad Adhikari

(Supervisor)

Date: February 14 2022

Defense Date: 6 March 2022.

Dedication

Honestly dedicated

To My parents

Father Tanka Prasad Aryal and Mother Padam Kumari Aryal

Declaration

This dissertation contains no material which has been accepted for the award of other degree in any institutions. To the best of knowledge and belief this dissertation contains no material previously published by any authors except due acknowledgement has been made.

Date: 6 March 2022

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Suresh Aryal

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……..

Suresh Aryal

Abstract

This study is entitled “Attitudes of teachers and students on using online tools in teaching and learning mathematics.” The purpose of this study is to identify teachers' and students' attitudes on using online tools in teaching and learning mathematics and to compare public and institutional school teachers' and students' attitudes. The data were collected by administrating questionnaire to 50 secondary school’s mathematics teachers and 103 students (from 15 Public and 9 institutional schools) of Dhading district by Accidental sampling method. The survey design was conducted to achieve the objectives of study. The questionnaire was prepared on the basis of four dimensions (Modes, ICT Knowledge, Access and Effectiveness). Attitudes of mathematics teachers and students on using online tools in teaching and learning mathematics were measured in five-point rating scale. The collected data were tabulated and analyzed by using SPSS software version 21.0 to get the value of chi-square test, percentage, mean and standard deviation and t-test for objective first and second respectively.

By analyzing and interpretation of obtained data, the researcher has found that secondary mathematics teachers and students attitudes towards online tools are not satisfactory; however they are using different online tools in this pandemic situation of Covid-19. It is concluded that Institutional and Public school’s mathematics teachers has no significance difference in attitudes on using online tools in teaching and learning mathematics. Likewise, Institutional and Public school’s students as well as mathematics teachers and students also have no significance difference in attitudes on using online tools in teaching and learning mathematics. This shows that mathematics teachers and students have same attitudes on using online tools in teaching and learning mathematics.

Table of Contents

List of Tables

Chapter I

Introduction

Background of the Study

Teaching Mathematics is the complex process. Teaching directly concerns to learning outcomes. Learning mathematics depends on different aspects such as classroom environment, curriculum, pedagogy, students' schema, technology etc. Many of the Universities and educational institutions are using the alternative ways of teaching mathematics in this digital era. Almost of the academic institutions are closed during the pandemic situation of Covid-19. They are unable to run their classes physically. This situation leads the teaching learning process into new era. In the urban area of Nepal, most of the private schools and some of the government schools too are using online tools such as Zoom app, Google Meet, Google Classroom, Microsoft Team, Messenger etc. for teaching mathematics. With these attempts, process of teaching and learning mathematics shifted from classical pedagogy to e-pedagogy. Jozef and Ivan (2012) states that e-pedagogy ensures and guarantees frequent and regular contact between the teacher and students as well as among students through online. Furthermore, e-pedagogy expands learning opportunities and provides quality education through different online tools.

Online teaching and learning is becoming popular in the field of teaching mainstream education along with mathematics. Many teachers are embracing this new form of course delivery as an opportunity. And just as many teachers perceive the move towards online courses as an ordeal, a threat or at least a source of stress. There is also

growing pressure on both teachers and institutions to offer their learners online learning options to supplement f2f (face-to-face) classes, due not only to the spectacular growth of technology and increased access to it over the last decade, but also due to the increasingly busy lifestyles of our adult learners and the increased 'tech-savviness' of our younger learners (Hockly & Clandfield, 2010).

As computer and emailing technology blossomed in the 1970s and 1980s, distance education with different modes began to expand dramatically. The first fully online course was offered in 1981, and the first online program was established by the Western Behavior Sciences Institute in the following year (Harasim, 2000). In the aid of using online tools in mathematics teaching Joseph and Ekemini (2014) states: It's no doubt saying that students' interest and motivation are low on pursuing career in mathematics courses, and the only way to bring a significant new group of learners to the fold is through the use of blended e-learning approaches. Furthermore, e-learning tools ensures that teaching and learning are ICT based, it enables students to have equal opportunities with their contemporaries in other part of the world and could be used to introduce an interesting variety of the inventory of instructional materials with relatives contents of mathematics (Joseph & Ekemini, 2014).

Teaching and learning mathematics through online tools have many challenges. Technology, ability of the teachers, ability of the students, online environment, virtual curriculum, attitude of the teachers and students etc. are the main issues related with online education. Mathematics teaching through online tools is more rigorous. The challenges of e-learning in mathematics education involve technological divides and limitations such as; lack of computers with high speed internet or intranet connections,

lack of computer peripherals, lack of functioning computer, online laboratory, content management software malfunctioning (i.e., internet insecurity) and/or other related ICT incompetence amongst students/educators (Jarvis, Misfeldt & Sanne, 2012). Similarly, Kalogeropoulos et al.(2020) stated that teaching mathematics through online tools lack social connectivity with students, difficulties with assessment, lack of real-time feedback, technology challenges with teachers and students. Having many challenges this pandemic has led to the new stage of Education i.e. online education, and need to harmonize methods of education with the requirements of new generations (Boca, 2021).

In the context of Nepal, no any governmental act is acting now for online education. Some institutions are voluntarily practicing this system. But it is highly necessary to launch the teaching learning activities by using online tools. To broaden the horizon of mathematics learning, teacher must use different online tools and help the students to create proper learning environment. One can gain the degree of mathematical knowledge through the use of online tools from all over the world and compete in the global market. It's the beauty of online learning. We should accept it. Having cited all these aforementioned situations on using online tools in teaching and learning mathematics, the researcher decided to identify and compare the attitudes of teachers and students towards online tools in teaching and learning mathematics.

Statement of the Problem

Mathematics teachers and students are seeking different ways of teaching and learning nowadays. Traditional type of face to face pedagogy is shifting to e-pedagogy and specifically online learning due to the flexibility of the location and time in online

learning. But some of the teachers and students raise the question on the effectiveness of learning mathematics by using different online tools. In the context of Nepal also, different universities like Tribhuvan University, Kathmandu University and some of the other institutions are also offering online education through synchronous tools even to teach mathematics. Secondary schools in Nepal are obliged to use online system to teach mathematics in the pandemic situation of Covid-19. Mathematics teachers, students and other stakeholders are realizing that online teaching as the effective way of delivering mathematical contents in this digital era.

The researcher has been practicing Zoom online tool to teach mathematics in his school. But less number of students is connected in Zoom class. Likewise, the researcher has faced many challenges towards online teaching in his school such as in the access, in the effectiveness, required knowledge of ICT, modes etc. The researcher has felt that some of the teachers and students are positive towards online learning but some of them are not. So, what is the real attitude of teachers and students on using online tools in teaching and learning mathematics was unknown. Hence, the researcher intended to study the attitudes of teachers and students on using online tools in teaching and learning mathematics.

The study is mainly concerned to the following research questions:

- What is the attitude of teachers on using online tools in teaching and learning mathematics?
- Is there same attitude among public school's teachers and institutional school teachers on using online tools in teaching and learning mathematics?

- What is the attitude of students on using online tools in teaching and learning mathematics?
- Is there same attitude among public school's students and institutional school's students on using online tools in teaching and learning mathematics?
- Is there same attitude among teachers and students on using online tools in teaching and learning mathematics?

Objectives of the Study

The objectives of this study are following:

i. To identify teachers and students' attitudes on using online tools in teaching and learning mathematics.
ii. To compare public and institutional school teachers and students' attitudes on using online tools in teaching and learning mathematics.

Justification of the Study

The justification of the study is a statement of why the study is being conducted, or the goal of the study. The goal of the study might to be identified or describe a concept or to explain or predict a situation or solution to a situation that indicates the type of study to be conducted (Adhikari, 2019).

Many of the educationists and stakeholders are enhancing the uses of online tools in teaching and learning. They argue that online tools broaden the area of learning. This research has investigated the attitudes of teachers and students on using online tools in teaching and learning mathematics.

Justification of this study can be dealt with following points:

i) It is helpful for the teachers to know the attitude of students towards online tools, their motivation and ability of using online tools and make the lesson plan according to it.

ii) It is useful for classroom practices as this study explores availability of internet with teachers and students, ICT knowledge with teachers and students etc.

iii) It is useful for subject experts and curriculum maker and book writers to develop online based mathematics courses, textbooks, and online materials.

iv) The result of this research is used as guideline for school administration and school management committee to upgrade the system of pedagogy.

v) This research helps the teachers and students to choose the better tools of online teaching according to their use.

Delimitation of the Study

Every study has delimitations due to the constraint of time, budget and other related factors. In like manner this study also had following limitations:

- This study had focused on secondary school students only.
- This study was centered on use of online tools in teaching and learning mathematics only.
- The study was limited at Dhading district.
- This study report may not be applicable in other levels or subjects.

- This study concludes the data obtained from Likert scale only by quantitative approach.
- The obtained data were analyzed by calculating frequency percentage, chi-square value and t-value only.

Operational Definition of Key Terms

Attitudes. Attitude is a settled way of thinking or feeling about something. It is an evaluation that people make about objects, ideas, events, or other people. In this study, attitude refers for teachers' and student' thinking towards online tools.

Online tools. Online learning tools refer to any program, app, or technology that can be accessed via an Internet connection and enhance a teacher's ability to present information and a student's ability to access that information. In this study online tools include Zoom APP, Google Meet, Microsoft Team and Messenger.

Teachers. In this study, teacher refers for the mathematics teachers from Nursery to class 12. They are categorized as public and institutional teachers. Those teachers teaching in public schools will be called public teachers and teachers teaching in institutional schools are called institutional teachers in this study.

Students. In this study, student refers for the students studying from Nursery to class 12.

Chapter II

Review of Related Literatures

A review of related literature is the sources of further study of research task. It helps to give the better idea of investigating in the research. Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic and to demonstrate to your readers how your research fits within a larger field of study (Arlene, 2005).Thus, the review of related literature is important and essential for guideline of research planning. The intention of this study was to identify and compare the attitudes of teachers and students towards online tools in teaching and learning Mathematics. There are different types of research in other countries related to this topic. But, there is less practice of research related to this idea in the context of Nepal. This chapter presents a review of related literature in an attempt to provide foundations and ground theory for an organized study of attitude of teachers and students towards online tools in teaching and learning mathematics.

Review of Theoretical Literature

Researches and theories are interrelated and inseparable. “A theory provides a conceptual framework for research. Research, in turn, contributes to the development of theory” (Pant, 2012 as cited in Adhikari, 2019). A theory plans and directs the research studies. Any philosophies must be supported by any theory for its pedagogical implementation. Likewise, use of online tools in teaching and learning mathematics is based on the theory connectivism.

Connectivism is a theoretical framework for understanding learning in a digital age with principles autonomy, connectedness, openness and diversity. It emphasizes how internet technologies such as web browsers, search engines, wikis, online discussion forums, and social networks contributed to new avenues of learning. Technologies have enabled people to learn and share information across the World Wide Web and among themselves in ways that were not possible before the digital age. Learning does not simply happen within an individual, but within and across the networks. The central aspect of connectivism is the metaphor of a network with nodes and connections. Connectivism recognizes three node types: neural, conceptual (internal) and external (Siemens, 2005).

A key feature of connectivism is that much learning can happen across peer networks that take place online. As Downes (2010) states, a teacher will guide students to information and answer key questions as needed, in order to support students learning and sharing on their own in connectivism learning. Students are also encouraged to seek out information on their own online and express what they find. A connected community around this shared information often results.

According to Klinger (2011), connectivity attained by forming links between mathematical know-how, language and other skills from the student's existing knowledge base serves to build understanding so that dependence on mathematical rules becomes redundant (in that, as a consequence of increasing fluency, they come to be seen as obvious consequences of the mathematics language rather than algorithmic procedures to be applied mechanistically). As the internal and reflective knowledge network grows by the formation of new connections that incorporate more and more nodes of both

congruent and disparate knowledge and experience. It undergoes periods of self-organizing criticality whereby there are cognitive phase transitions that spontaneously yield flashes of emergent deeper understanding. Increasingly, the learner is empowered to undertake self-directed learning according to need or inclination.

The use of online tools in teaching and learning mathematics is based on above assumptions of the theory connectivism since it focuses on the learning that happens through synchronous tools. From a learner-centered teaching perspective, connectivism provides opportunities for students to make choices about their learning. Connectivism promotes group collaboration and discussion, allowing for different viewpoints and perspectives to aid in problem-solving, decision-making, and making sense of information. Furthermore, in connectivist classes students are motivated to share their ideas, experiences and expand their knowledge through online tools. Based on these components of connectivism learning theory and specific nature of online courses and e-learning environments, the study was based on connectivism. and the following themes are created under connectivism.

Thematic Review

Thematic reviews of literature are organized around a topic or issue, rather than the progression of time. This method of data organization is based on grouping different literature sources by their topic and theoretical concept in order by their relevance and importance. The following themes are created under connectivism for this study:

Virtual learning environment. The Virtual Learning Environment (VLE) is a technology that supports learning through face-to-face and virtual meetings (Barajas & Owen, 2000). VLE is characterized by an environment based on computers, use of the internet, interaction between users, exchange of views and access to users to obtain various useful materials (Wilson, 1996). VLE is a software tool that supports the management of education and teaching by using the internet. The VLE concept is more comprehensive compared to computer-aided instructions as it contains the communication dimension as well as interaction and discussions between teachers and students or among students (Piccoli, Ahmad, & Ives, 2001). In other words, VLE is a web-based learning platform, which is a reality in the education world, which integrates the conventional education concept with the virtual method. Furthermore, authors referred VLE as an online classroom and a social space in schools that contains a calendar, social networks, shared work space and online assessment.

Some studies have given another name or concept for VLE, such as e-learning, online learning, distance learning or web-based learning (Selinger, 2001).In addition, the researchers adds that individuals who experience virtual learning would also experience permanent changes that involve the mentality, attitude, thinking and behavior due to receiving knowledge, supervision and access from online learning resources . So, in virtual learning environment; teaching activities are carried out online whereby the teacher and learners are physically separated in terms of place, time, or both.

Issues of online learning. Anna and Xiufang (2016) argued that effective online instruction is dependent upon 1) well-designed course content, motivated interaction between the instructor and learners, well-prepared and fully-supported instructors; 2)

creation of a sense of online learning community; and 3) rapid advancement of technology.

Likewise, Fakhrunisa and Prabawanto (2020), in their paper "Online Learning in Covid-19 Pandemic: An Investigation of Mathematics Teachers' Perception" aimed to revealed the mathematics teachers' perception of online mathematics learning challenges and possibilities. This survey results indicate that educational experience is one of the things that will vary the ability of teachers in presenting online learning. The analysis of survey results reveals that mathematics teachers had a positive perception of online learning implementation. However, teachers face some challenges to implement online learning, such as teacher readiness in running applications to carry out online learning, online learning facilities for students, limitations in achieving learning that demands mathematical thinking, and constraints in giving feedback to students. Meanwhile, some teachers also think that online learning has various advantages including encourage students to learn more independently, encourage students and teachers to master ICT, study time is more flexible, accommodate students to be more creative in doing. In this sense, online learning environment is opportunity and challenge too in this digital era.

Kalogeropoulos et al.(2020) stated online teaching is more effective in the period of COVID-19 except for the lack of opportunity to learn mathematics with and from their peers, lack of social connectivity with students, difficulties with assessment, lack of real-time feedback, technology challenges with teachers and students.

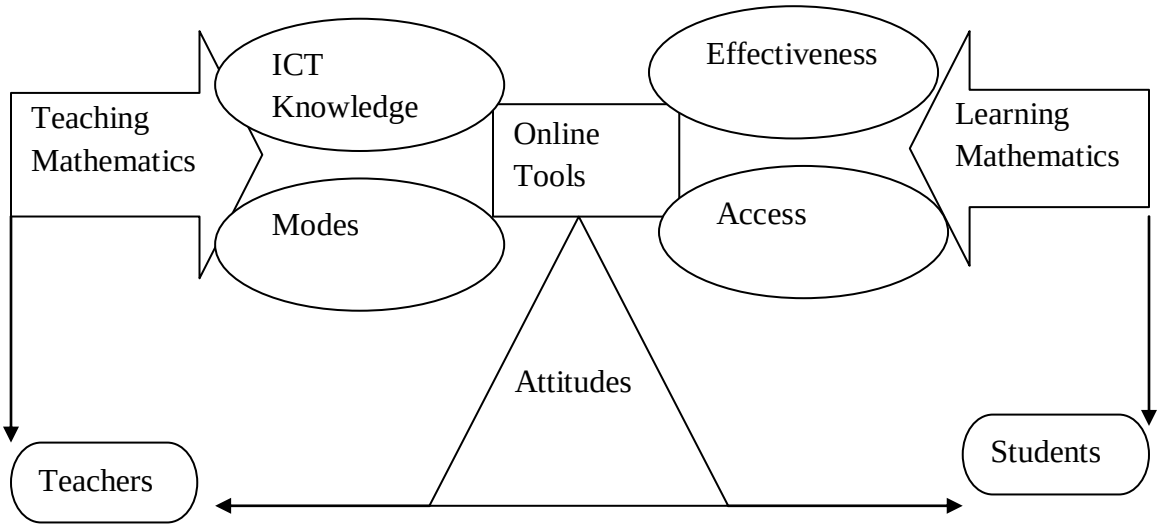
From the above discussion, the researcher concluded that online learning environment has become the greatest boon for teaching and learning in this digital era. It

is the best way for teaching and learning in this pandemic environment of Covid-19 by using online tools. But it has some challenges too. ICT Knowledge, Access of internet with teachers and students, modes of online tools, effectiveness etc. are the areas to be discussion. Specifically, the researcher intended to find out and compare the attitudes of mathematics teachers and students on using online tools in teaching and learning mathematics; and not found of having the research on this topic yet, had decided to study.

Conceptual Framework

A conceptual framework is presented either in graphical or narrative forms which depicts the relation between the variables, brings clarity, focus to see and organize the research questionnaire more clearly. The researcher had made the following conceptual framework for the study under connectivism.The researcher had taken the help from Andersson and Gronlund (2009) to construct the conceptual framework.

Fig. 1. Attitudes of teachers and students on using online tools in teaching and learning mathematics



The above conceptual framework depicted the evolution of research topic. Firstly the researcher made survey on using online tools mainly in four areas i.e. Access, Modes, Effectiveness and ICT Knowledge on the behalf of teaching and learning mathematics for mathematics teachers and students respectively. For the fulfillment of the objective first institutional teachers and public teachers were provided a questionnaire based on Likert scale. Similarly, secondary school students were provided a questionnaire. This helped to find out the attitudes of teachers and students towards online tools in teaching and learning mathematics. And then, the researcher compared the responses of institutional teachers and public teachers and concluded the attitude of mathematics teachers. Likewise, the researcher compared the responses of institutional school's students with public school's students which ensured the attitudes of students on using online tools in teaching and learning mathematics. Then after the researcher compared and analyzed the attitudes of teachers and students on using online tools for the achievement of second objective.

Chapter III

Methods and Procedures

This chapter presents the detail blueprint of the study, which is carried out to achieve the objectives of the study. It is designed for describing the research methodology. The research methodology is useful to solve the research problem in a systematic manner. This chapter consist the design of research, population of the study, data collection tools, reliability and validity of tools, data collection procedure and procedure of data analysis.

Design of the Study

The most popular quantitative research design in the social science is survey research. According to Muijs (2004); survey research designs are quite flexible and can therefore appear in a variety of forms, but all are characterized by the collection of data using standard questionnaire forms administered by telephone or face to face, by postal pencil and paper questionnaires or increasingly by using web-based and e-mail forms. The survey research design is map or guideline for this research. It provides the fundamental ways to conduct this research work successfully. It guides the whole process of the intended research. In this research, the questionnaire was asked to the mathematics teachers and students for the purpose of collecting the data and achieved objectives via Google Form. Hence, the survey research design was suitable and used to attain the objectives for this research study.

Population of the Study

There are 617 secondary schools in Dhading district in which 564 are public schools and 53 are institutional schools (Education Development and Coordination Unit, 2078). The population of this research was all the mathematics teachers of those 617 schools who are using online tools for teaching mathematics and all the students of same level who are using online tools for learning mathematics.

Sample of the Study

The researcher used accidental sampling. Accidental sampling is a type of non-probability sampling. Where members of the target population that meet certain practical criteria, such as easy accessibility, geographical proximity, availability at a given time or the willingness to participate are included for the purpose of the study(Etikan, Musa, & Alkassim, 2016).The researcher had taken the views of 21 mathematics teachers and 47 students from 7 institutional schools. Likewise, the researcher had taken 29 mathematics teachers and 56 students from 10 public schools.

Tools of Data Collection

It is an important part of the study. To fulfill the objective, necessary data should be collected. There are many data collection tools. In this research, the researcher has used Questionnaire as data collection tool which is described as follow.

Questionnaire. Questionnaire is an important tool using for data collection in the research. The researcher prepared a set of questionnaires of 32 statements on the basis of conceptual framework with four dimensions (Access, Modes, Effectiveness and ICT Knowledge). Questionnaire was developed based on Likert's five-point Scale where

respondents should be answered as Strongly Agree, Agree, Neutral, Disagree and Strongly Disagree respectively. Rank response for each statement through each aspect will be Strongly Agree, Agree, Neutral, Disagree, and Strongly Disagree. Each positive statement was provided five point for strongly agree, four for agree, three for neutral, two for disagree and one for strongly disagree. In the next hand, for negative statements the researcher provided one point for strongly agree, two for agree, three for neutral, four for disagree and five for strongly disagree.

Reliability and Validity of Tools

For the validation of tools researcher made the questionnaire form based on conceptual framework. To ensure the validity of instruments, the researcher had consulted with thesis supervisor. Reliability concerns to degree to which a measuring instrument gives similar results over number of repeated trials. In this survey, researcher has conducted the pilot test to ensure the reliability of questionnaire among five teachers and five students of Chitwan district, which is not included in the study. For reliability, obtain data was calculated by using Statistical Package for Social Sciences (SPSS) programmer, version 21.0, setting at 0.05. The Cronbach's α was found 0.77(>0.60) on questionnaire of teachers and 0.76 was found on questionnaire of students, which are highly reliable for each statement.

Data Collection Procedure

Data is the foundation of any research. Therefore, collection of reliable data is very essential part of all types of research. The researcher made questionnaire in Google Form and provided the link to 50 mathematics teachers who are teaching mathematics

through online. Then, the researcher messaged them to fill up questionnaire on the perception. Similarly, the researcher consulted with 10 mathematics teachers from different schools in his convenient and provided the link of Google form to their students. Then, collected data from 103 students was tabulated. Each statement followed through each aspect by the rank responses in five-point Likert-scales.

Data Analysis and Interpretation Procedure

Data analysis is considering as important step and heart of the research work. After collection of data with the help of relevant tools and technique, the next logical step is to analyze and interpret data with a view to arriving empirical solution of problem (Dahal, 2019).

After the completion of data collection, the researcher analyzed the obtained data by using the statistical procedure. The researcher analyzed the obtained data by using the Statistical Package for Social Science (SPSS) software version 21.0. Nonparametric chi-square test was calculated for each statement by percentage to find the attitude of mathematics teachers and students on using online tools on four dimensions (access, modes, effectiveness and ICT knowledge) in teaching and learning mathematics. For achievement of second objective to compare the attitudes of mathematics teachers and students on using online tools in teaching and learning mathematics, t-test at 0.05 level of significance, mean and standard deviation was used.

Chapter IV

Analysis and Interpretation of Data

This chapter deals about statistical analysis and interpretation of collected data related to attitudes of teachers and students on using online tools in teaching and learning mathematics. The collected data were tabulated and analyzed by using the Statistical Package for Social Science (SPSS) software version 21.0 setting. Frequency percentage and chi-square test were calculated. Likewise, t-test at 0.05 level of significance, mean and s.d. were used for analyzing the data. The collected data were analyzed under the following headings, correspondence to the objectives of the study.

• Attitude of teachers on using online tools in teaching and learning mathematics.

• Attitude of Students on using online tools in teaching and learning mathematics.

• Comparison of Public School teachers' and Institutional School teachers' attitudes on using online tools in teaching and learning mathematics.

• Comparison of Public School students' and Institutional School students' attitudes on using online tools in teaching and learning mathematics.

• Comparison of attitude of teachers and students on using online tools in teaching and learning mathematics.

Attitude of Teachers on Using Online Tools in Teaching and Learning Mathematics

To achieve the first objective of study, 50 secondary school's mathematics teachers were selected. The questionnaire is given in (Appendix-A) and their responses

are tabulated and calculated by using five-point rating scale. The obtained result was categorized according to different themes; Modes, ICT Knowledge, Access and Effectiveness. The analysis and interpretations of each category is presented separately in the succeeding sections.

Modes. Modes is the first dimension among four dimensions. Statements 1 to 8 are related to Zoom app, Google Meet, Microsoft Team and Face book Messenger. This table consist the attitudes of secondary school mathematics teacher's on modes of online tools in teaching and learning mathematics. The result under this category is presented in table 4.1.

Table 4.1: Responses of Mathematics Teachers on Modes.

	Statements	**S%**	**A %**	**N%**	**D%**	**S%**	**$\chi 2$**	**D**
	Modes							
1.	Zoom app is useful to teach mathematics.	30.0	38.0	8.0	4.0	20.0	20.6	S
2.	Google meet is useful to teach mathematics.	16.0	40.0	20.0	22.0	2.0	18.6	S
3.	Zoom app is best for sharing screen.	30.0	34.0	4.0	16.0	16.0	14.6	S
4.	Google meet has no time limit bound which helps to extend the class.	38.0	30.0	8.0	8.0	16.0	18.2	S
5.	Microsoft team is useful to teach mathematics through online.	14.0	30.0	30.0	4.0	22.0	12.4	S

6.	Face book Messenger is means of teaching mathematics via online.	2.0	18.0	12.0	44.0	24.0	24.6	S
7.	Microsoft Team is difficult to use.	12.0	16.0	42.0	8.0	22.0	17.8	S
8.	There are others effective modes of online teaching except Zoom, Google meet, Microsoft team and Face book messenger.	18.0	22.0	36.0	8.0	16.0	10.6	S

SA=Strongly Agree, A= Agree, N=Neutral, D=Disagree, SD= Strongly Disagree and D=Decision, Critical region: $\chi 2_{\alpha,V} = \chi 2_{\mathbf{0.05,4}} = 9.49$

As analyzed in the table 4.1, the $\chi 2$ -value of statement one is 20.65 which is significant at 0.05 level of significance Thus, this statement preserves goodness of questionnaire. As table 4.1 shows that in statement one, a total of more than two third teachers responded on Strongly Agree and Agree. It concludes that more than two third of the teachers agrees that Zoom app is useful to teach mathematics to their students via online. Moreover, table shows that statement 2 is significant with $\chi 2$ -value 18.6, means this statement preserves goodness of the questionnaire. A total of more than half number of the teachers responded on Strongly Agree and Agree, but least number of teachers responded on Disagree and Strongly Disagree. This result indicates that most of the teachers uses Google meet to teach mathematics through online. In the same manner, statement 3 preserves the goodness of questionnaire with $\chi 2$ -value 14.6. Nearly two third of the total teachers responded on Strongly Agree and Agree but least number of teachers

responded on Disagree and Strongly Disagree. Very less number of teachers responded on Neutral. It concludes that most of the teachers agree that Zoom app is best for sharing screen in online class. Since the $\chi 2$ -value of statement 4 is 18.2 (>critical region=9.49), it is significant. Similarly, more than two third of the teachers responded on strongly agree and agree; which concludes that time limit boundlessness of the Google Meet helps to extend the class. Statement 5 has chi-square value 12.4, which assigns the significant to the questionnaire. Nearly one third of the teachers responded Neutral; one third of the teachers responded Agree and nearly one fourth responded Disagree and Strongly Disagree for statement 4. It concludes that less number of mathematics teachers is aware with Microsoft Team and those who are using also stated that Microsoft Team is less useful to teach Mathematics through online. In like manner, Statement 6 has $\chi 2$ -value 24.6, which ensures the goodness of the questionnaire. Only one fifth of the teachers responded on strongly agree and agree but more than two third of the total teachers responded on Disagree and Strongly Disagree. It ignores the statement that face book messenger is means of teaching mathematics via online and concluded that face book messenger is not proper means of online tools in teaching mathematics. Similarly, the $\chi 2$ -value of statement 7 is 17.8, which is significant. Less than one third of the teachers responded on agree and strongly agree; nearly half of the total teachers stayed neutral and less than one third of the teachers answered disagree and strongly disagree. It can be concluded that nearly half percent of the teachers are less aware in the use of Microsoft Team. Likewise, statement 8 has chi-square value 10.6 which is above the critical region. This means the statement is significant. Forty percent of the teachers responded on Strongly Agree and Agree for statement 8; but more than one third of the teachers

answered neutral and nearly one fourth of the teachers responded Disagree and Strongly Disagree. From this, it can be concluded that teachers has less idea that either there is others effective modes except Zoom, Google Meet, Microsoft Team and Face book Messenger or not.

From this above analysis, the researcher found that more than 60% of the total teachers used Zoom and Google Meet to teach mathematics via online to their students and expressed Zoom and Google meet are more useful than other tools. Nearly less than one third of the teachers used Microsoft Team and felt difficult to use as well. Similarly, only one fifth of the teachers considered face book messenger is useful in teaching and learning mathematics.

ICT Knowledge. ICT Knowledge is second dimension among four dimensions. Statements 9 to 16 are related to ICT Knowledge and their uses in online teaching learning process. This table consist the attitudes of mathematics teachers on ICT Knowledge in teaching and learning mathematics through online. The result under this category is presented in table 4.2.

Table 4.2: Responses of mathematics teachers on ICT Knowledge

Statements	**S%**	**A %**	**N%**	**D%**	**S%**	χ **2**	**D**
ICT Knowledge							
9. ICT Knowledge is required to teach mathematics through online	38.0	26.0	12.0	14.0	10.0	14.0	S

10.	ICT makes my lesson more diverse	22.0	42.0	12.0	14.0	10.0	17.2	S
11.	ICT are not sufficient for teaching concepts of mathematics	28.0	44.0	12.0	6.0	10.0	25.0	S
12.	ICT provides instructional materials	22.0	50.0	16.0	4.0	8.0	33.0	S
13.	Using ICT in teaching mathematics via online is difficult job	8.0	20.0	24.0	34.0	14.0	9.8	S
14.	I can teach mathematical information from the internet more than from books	20.0	16.0	24.0	26.0	14.0	2.6	NS
15.	Using ICT in teaching mathematics demonstrates the mathematical concept to students	16.0	44.0	16.0	12.0	12.0	18.4	S
16.	I have taken ICT training	26.0	34.0	8.0	16.0	16.0	10.2	S

As analyzed in table 4.2, statement 9 is significant with $\chi 2$-value 14.0. Nearly two third of the total teachers responded on strongly agree and agree; nearly one fourth of the teachers responded on strongly disagree and disagree. This means most of the teachers agreed that ICT knowledge is required to teach mathematics through online and minimum number of teachers didn't agree that ICT knowledge is required to teach mathematics through online. Likewise, $\chi 2$-value of statement 10 is 17.2 which is significant and it preserves the goodness of statement. More than 50% of the teachers

responded on strongly agree and agree and only one fourth of the teachers responded on disagree and strongly disagree. It shows that most of the teachers agreed on the statement "ICT makes my lesson more diverse". Similarly, statement 11 is significant with $\chi 2$-value 25.0. Nearly three fourth of the total teachers responded on strongly agree and agree. This means most of the teachers agreed on ICT are not sufficient for teaching concepts of mathematics. As $\chi 2$-value of statement 12 is 33.0; the statement is significant. Nearly three fourth of the teachers responded on strongly agree and agree but nearly only one tenth of the total teachers responded on strongly disagree and disagree. This can be concluded that most of the teachers agreed on statement "ICT provides instructional materials" but very few teachers disagree on it. Statement 13 has chi-square value 9.8 which is significant. About one fourth of the total teachers responded strongly agree and agree for statement 13 and nearly one fourth stayed neutral on it. Similarly, about half of the total teachers responded on strongly disagree and disagree. This shows most of the teachers are didn't agree that using ICT via online is difficult job. The $\chi 2$-value of statement 14 is 2.6 which lie in critical region. This means statement 14 is not significant; it doesn't preserve the goodness of questionnaire. More than one third of teachers responded on strongly agree and agree. In the same way one fourth of the teachers were neutral and forty percent of the teachers responded on disagree and strongly disagree. This means teachers had shared their views equally on agree and disagree in the statement "I can teach mathematical information from the internet more than from books". Statement 15 and 16 preserves the goodness of the questionnaire having chi-square value 18.4 and 10.2 respectively. Sixty percent of the total teachers responded agree and strongly agree and only one fourth of the teachers responded disagree and

strongly disagree for statement 15. It implies most of the teachers agreed that using ICT in teaching mathematics demonstrates the mathematical concepts to the students. In like manner, 60% of the teachers responded on agree and strongly agree for statement 16.But, less than one tenth of the total teachers stayed neutral and nearly one third of the total teachers responded disagree and strongly disagree. This shows that only 60% of the mathematics teachers had taken ICT training. And nearly one third of the teachers had not taken ICT training yet.

From this above analysis, the researcher has found that most of the mathematics teachers agreed that ICT knowledge is required to teach mathematics via online which makes lesson more diverse but ICT only is not sufficient. Using ICT demonstrates the mathematical concepts to the students. Furthermore, the researcher has found that still one third of the total teachers had not taken ICT training.

Access. Access is the third dimension among four dimensions. Statements 17 to 24 are related to access. Access refers for Wi-Fi, 4 G network, use of internet, availability with students and in community. This table consist the attitudes of mathematics teachers on Access in teaching and learning mathematics through online. The result under this category is presented in table 4.3.

Table 4.3: Responses of mathematics Teachers on Access

Statements	**SA%**	**A%**	**N%**	**D%**	**S%**	χ **2**	**D**
Access							
17. I use Wi-Fi to teach my students	22.0	38.0	8.0	16.0	16.0	12.6	S

18.	There is easy access of internet in my community	10.0	14.0	20.0	24.0	32.0	7.4	NS
19.	I use mobile data to teach my students	20.0	36.0	24.0	16.0	4.0	13.6	S
20.	4 G network is available in my community	22.0	6.0	24.0	26.0	22.0	6.4	NS
21.	Using mobile data in teaching through online is more expensive	48.0	8.0	12.0	14.0	18.0	25.8	S
22.	All of my students are connected with me in my online class	10.0	14.0	16.0	26.0	34.0	9.6	S
23.	I use internet to search learning materials	18.0	34.0	16.0	4.0	28.0	13.4	S
24.	There is no problem of fluctuation of internet.	12.0	8.0	16.0	38.0	26.0	14.6	S

As analyzed in table 4.3, statement 17 has $\chi 2$-value 12.6; which is significant. It preserves the goodness of the statement. Sixty percent of the teachers responded on strongly agree and agree for statement 17 but about one third of the teachers responded on disagree and strongly disagree. This implies more than half of the total teachers used Wi-Fi to teach their students but still one third of the total teachers have no facilities of Wi-Fi. As $\chi 2$-value of the statement 18 is 7.4 and it lies in critical region; statement 18 is not significant. Only less than one fourth of the total teachers responded on strongly agree and agree but more than half of the total teachers responded on strongly disagree and disagree. Similarly one fifth of the total teachers stayed neutral. This means most of the teachers have no easy access of internet in their community. The $\chi 2$-value of statement 19 is 13.6; which lies above the critical value. So, statement 19 is significant.

More than half of the total teachers responded on strongly agree and agree for statement 19 but only one fifth of the total teachers responded on strongly disagree and disagree. This implies more than half of the total teachers use mobile data to teach their students via online. Likewise, statement 20 is not significant with $\chi 2$-value 6.4. Only one fourth of the total teachers responded agree and strongly agree for this statement but nearly half of the total teachers responded on disagree and strongly disagree. This shows that less number of teachers agreed on "4 G network is available in my community" and about 50% of teachers disagreed on this statement. In like manner, statement 21 is significant with $\chi 2$-value 25.8. More than half of the total teachers responded on agree and strongly agree for statement 21 but nearly one third of the total teachers voted on disagree and strongly disagree. This shows that most of the teachers agreed on the statement "Using mobile data in teaching through online is more expensive". Similarly, statement 22 is significant with chi-square value 9.6. This signifies the goodness of the questionnaire. Also, only one fourth of the teachers responded on agree and strongly agree but 60% of the teachers responded on disagree and strongly disagree. This symbolize most of the teachers disagreed on the statement "All of my students are connected with me in my online class". From the table, statement 23 and 24 are significant with $\chi 2$-value 13.4 and 14.6 respectively; which preserves the goodness of the statement. More than half of the total teachers responded on strongly agree and agree for statement 23 and nearly one third of the teachers responded on disagree and strongly disagree. This means more than half of the total teachers use internet to search learning materials where as one third of the teachers never use. Only one fifth of the total teachers responded agree and strongly agree for statement 24 but nearly two third of the total teachers responded on disagree

and strongly disagree. This implies most of the teachers agreed that there is problem of fluctuation of internet.

From this above analysis, the researcher has found that there is no easy access of internet in their community. Teachers use Wi-Fi as well as mobile data to teach their students but 4 G network is not available in their community. Furthermore the researcher has identified that using mobile data in teaching through online is more expensive and all of their students are not connected in online class. There is problem of fluctuation of internet.

Effectiveness. Effectiveness is the fourth dimension among four dimensions. Statements 25 to 32 are related to effectiveness. Effectiveness includes student's achievement, interest, evaluation, time to complete the course etc. This table consist the attitudes of mathematics teachers on Effectiveness in teaching and learning mathematics through online. The result under this category is presented in table 4.4.

Table 4.4: Responses of Mathematics Teachers on Effectiveness

Statements	**SA%**	**A%**	**N%**	**D%**	**S%**	χ **2**	**D**
Effectiveness							
25. Teaching learning activities is more effective via online tools	2.0	14.0	14.0	34.0	36.0	21.2	S
26. Online tools help to increase student's achievement	8.0	12.0	8.0	42.0	30.0	23.4	S
27. Using online tools make the students understand mathematics	10.0	12.0	16.0	24.0	38.0	13.0	S

	more							
28.	Online tools help to encourage the interest of the students	12.0	18.0	16.0	28.0	26.0	4.6	NS
29.	Using online tools motivates students for learning	6.0	10.0	36.0	26.0	22.0	14.8	S
30.	Online tools help to evaluate the students	0.0	12.0	8.0	32.0	48.0	20.7	S
31.	Teaching through online lengthen the time to complete the course	40.0	40.0	4.0	10.0	6.0	33.8	S
32.	Using online tools in teaching mathematics can not address the weak students	40.0	30.0	8.0	16.0	6.0	21.4	S

As analyzed in table 4.4, statement 25, 26 and 27 are significant with $\chi 2$-value 21.2, 23.4 and 13.0 respectively. It preserves the goodness of the statements. Less than one fifth of the total teachers responded on strongly agree and agree for statement 25 but 70% of the teachers responded on disagree and strongly disagree. This means most of the teachers disagreed on the statement "Teaching learning activities is more effective via online tools". Likewise only one fifth of the total teachers responded on strongly agree and agree for statement 26 where as 72% of the total teachers voted on disagree and strongly disagree. It implies online tools don't help to increase student's achievement. In like manner, about one fifth of the total teachers agree and strongly agree on statement 27 but more than sixty percent of the teachers voted on disagree and strongly disagree. From this, it can be concluded that most of the teachers do not accept that online tools make the students understand mathematics more. As the $\chi 2$-value of statement 28 is 4.6 lie in the critical region, statement 28 is not significant. It means it doesn't preserve the goodness

of questionnaire. Only one fifth of the teachers responded on agree and strongly agree for statement 28 but more than half of the total teachers responded on disagree and strongly disagree. Also about one fifth are neutral. This means most of the mathematics teachers didn't agree that online tools help to encourage the interest of the students. Similarly, statements 29 and 30 have the chi-square value 14.8 and 20.7 respectively; which are significant. Less than one fifth of the teachers responded on strongly agree and agree where as more than one third of the teachers stayed neutral and nearly half of the total teachers responded disagree and strongly disagree for statement 29. This implies less number of teachers only agreed that using online tools motivates students for learning. Likewise, no teacher responded strongly agree for statement 30. Only nearly one tenth of the total teachers agreed with statement 30 but 80% of the total teachers responded disagree and strongly disagree on it. It can be concluded that large number of teachers disagreed on the statement "online tools help to evaluate the students". In like manner, statements 31 and 32 have the chi-square value 33.8 and 21.4 respectively; which is sufficiently significant. It assures the goodness of the questionnaire. 80% of the teachers responded on agree and strongly agree for statement 31 but less than one fifth of the total teachers only responded on disagree and strongly disagree. This implies most of the teachers agreed that teaching through online lengthen the time to complete the course. In the same way, 70% of the teachers responded on strongly agree and agree for statement 32 but about only one fifth of the total teachers responded on strongly disagree and disagree. Which implies most of the teachers agreed that using online tools can not address the weak students.

From this above analysis, the researcher has found that teaching learning activities via online tools is not effective. Online tools don't help to increase student's interest and achievement. Using online tools doesn't motivate the students for learning. Furthermore, an online tool is not useful in the evaluation of the students and online tools lengthen the time to complete the course. The researcher has found that using online tools in teaching mathematics can not address the weak students.

Attitude of Students on Using Online Tools in Teaching and Learning Mathematics

To achieve the first objective of study, 103 secondary school's students were selected. The questionnaire is given in (Appendix-B) and their responses are tabulated and calculated by using five-point rating scale. The obtained result was categorized according to different themes; Modes, ICT Knowledge, Access and Effectiveness. The analysis and interpretations of each category is presented separately in the succeeding sections.

Modes. Modes is the first dimension among four dimensions. Statements 1 to 8 are related to Zoom app, Google Meet, Microsoft Team and Face book Messenger. This table consist the attitudes of secondary school student's attitudes on modes of online tools in teaching and learning mathematics. The result under this category is presented in table 4.5.

Table 4.5: Responses of Students on Modes.

Statements	SA%	A%	N%	D%	S%	$\chi 2$	D
Modes							
1. Zoom app is useful to learn mathematics via online.	30.1	38.8	3.9	3.9	23.3	50.8	S
2. Google meet is useful to learn mathematics.	17.5	53.4	17.5	9.7	1.9	80.4	S
3. Zoom app is best for sharing screen to show my homework and class-work to my teachers.	32	36.9	3.9	13.6	13.6	39.8	S
4. Google meet has no time limit bound which helps to extend the class.	41.7	40.8	0	5.8	11.7	44.3	S
5. Microsoft team is useful to learn mathematics through online.	5.8	15.5	62.1	0	16.5	78.6	S
6. Face book Messenger is effective means of learning mathematics via online.	0	15.5	11.7	44.7	28.2	27.7	S
7. Microsoft Team is difficult to use.	11.7	9.7	65	7.8	5.8	131.6	S
8. There are others effective modes of online learning except Zoom, Google meet, Microsoft team and Face book messenger.	3.9	9.7	63.1	7.8	15.5	123.3	S

As analyzed in table 4.5, statement 1 has $\chi 2$-value 50.83; which is significant. This preserves the goodness of the questionnaire. More than two third of the total students responded on strongly agree and agree but nearly only one fourth of the total students responded on disagree and strongly disagree for statement 1. This means most of the students agrees that Zoom app is useful to learn mathematics via online. Similarly, statement 2 has chi-square value 80.35.This means the given statement is significant. More than 70% of the students responded on agree and strongly agree but nearly one tenth of the total students only responded on disagree and strongly disagree. This implies most of the students agreed that Google meet is useful to learn mathematics. Likewise, $\chi 2$-value of statement 3 is 39.77; which is significant. More than two third of the total students voted on agree and strongly agree but only one fourth of the total students responded on disagree and strongly disagree. This means most of the students responded that Zoom app is best for sharing screen to show their homework and class-work to their teacher. Similarly, statement 4 has the chi-square value 44.3 which is above the critical region. That means statement 4 is significant. More than 80% of the students responded on agree and strongly agree for statement 4 and no one is neutral. It implies that most of the students agreed on statement "Google meet has no time limited bound which helps to extend the class". Moreover, statement 5, 6, 7 and 8 are also significant with $\chi 2$-value 78.6, 27.4, 131.6 and 123.3 respectively. Only one fifth of the total students agreed on statement 5 but more than 60% of the students stayed neutral on it. This means most of the students didn't declare either the Microsoft Team is useful to learn mathematics or not. That is; most of the students were not using Microsoft Team. No students responded on strongly agree for statement 6 but more than 70% of the students responded on

strongly disagree and disagree on it. That concludes very few students accepted that face book messenger is effective means of learning mathematics; whereas most of the students didn't take face book messenger as the effective means of learning mathematics via online. 65% of the total students stayed neutral for statement 7. Form this it can be concluded that most of the students are unknown about Microsoft Team and they can't declare either it is difficult to use or not. Furthermore, about only one tenth of the total students responded on strongly agree and agree, 65% stayed neutral and about one fifth of the total students replied disagree and strongly disagree for statement 8. This means most of the students didn't know either there are others effective modes of online learning except Zoom, Google meet, Microsoft Team and face book messenger or not.

From this above analysis, the researcher has found that most of the students are using Zoom and Google Meet to learn mathematics via online and Zoom and Google meet are more useful than others. But most of the students are unknown about Microsoft Team. Zoom app is best for sharing screen to show their class work and homework to their teachers. Likewise, Google Meet has no time limited bound which helps to extend the class. Furthermore, the researcher has found that face book messenger is not the effective means of learning mathematics via online.

ICT Knowledge. ICT Knowledge is second dimension among four dimensions. Statements 9 to 16 are related to ICT Knowledge and their uses in online teaching learning process. This table consist the attitudes of students on ICT Knowledge in teaching and learning mathematics through online. The result under this category is presented in table 4.6.

Table 4.6: Responses of Students on ICT Knowledge

Statements	SA%	A%	N%	D%	S%	$\chi 2$	D
ICT Knowledge							
9. ICT Knowledge is required to learn mathematics through online	35.9	29.1	11.7	13.6	9.7	28.5	S
10. ICT knowledge helps me to learn mathematics more effectively	20.4	54.4	5.8	9.7	9.7	82.1	S
11. ICT are not sufficient for understanding concepts of mathematics	29.1	47.6	11.7	5.8	5.8	67.7	S
12. ICT provides learning materials	23.3	49.5	15.5	3.9	7.8	67.5	S
13. Using ICT in learning mathematics via online is difficult job	3.9	19.4	13.6	44.7	18.4	46.9	S
14. I can get mathematical information from the internet more than from books	32.0	44.7	7.8	9.7	5.8	62.3	S
15. Using ICT in teaching and learning mathematics demonstrates mathematical concept to students	32.0	48.5	9.7	3.9	5.8	78.6	S
16. I have proper ICT knowledge	6.8	11.7	5.8	36.9	38.8	55.9	S

As analyzed in table 4.6, statement 9 has $\chi 2$-value 28.5; which is significant. Nearly two third of the total students responded on agree and strongly agree for statement 9 but only one fifth of the total teachers responded on disagree and strongly disagree. From this it can be concluded that most of the students believe that ICT knowledge is required to learn mathematics through online. Similarly, statement 10 is significant with $\chi 2$-value 82.09. This preserves the goodness of the questionnaire. Nearly three fourth of the total students responded agree and disagree but less than one fifth of the total teachers responded disagree and strongly disagree in statement 10. This means most of the students said that ICT knowledge help them to learn mathematics more effectively. Statements 11, 12, 13, 14, 15 and 16 are significant with $\chi 2$-values 67.7, 67.5, 46.95, 62.29, 78.6 and 55.8 respectively. More than three fourth of the total teachers agree and strongly agree on the statement 11. This means they agreed on the statement " ICT are not sufficient for understanding concepts of mathematics". Likewise, more than 70% of students have responded strongly agree and agree but only one tenth of the total students disagree and strongly disagree for statement 12. This implies most of the students agreed that ICT provides learning materials. Similarly, only one fifth of the total students responded strongly agree and agree for statement 13 but more than 60% of the students disagree and strongly disagree on it. It means, most of the students do not consider that use of ICT in learning mathematics is difficult job. This concludes using ICT in learning mathematics via online is not difficult job. Furthermore, more than 75% of the students agree and strongly agree with statement 14 but less than one fifth of the total students disagree or strongly disagree on it. It can be concluded that most of the students agreed that they can get mathematical information from the internet more than from books.

Likewise, more than 80% of the students agree and strongly agree with statement 15 where as very few numbers of students disagree on it. This symbols using ICT in teaching and learning mathematics demonstrates mathematical concept to students. But for statement 16; less than one fifth of the students agree or strongly agree and 75.7% of the students disagree or strongly disagree. This means most of the students have no proper ICT knowledge.

From this above analysis, the researcher has found that ICT knowledge is required to learn mathematics through online but ICT only is not sufficient. Also ICT provides learning materials. Similarly the researcher has found that most of the students agreed that they can get mathematics information from the internet more than from books. Most of the students have no proper ICT knowledge but they don't feel using ICT in learning mathematics via online is difficult job.

Access. Access is the third dimension among four dimensions. Statements 17 to 24 are related to access. Access refers for Wi-Fi, 4 G network, use of internet, availability with students and in community. This table consist the attitudes of students on Access in teaching and learning mathematics through online. The result under this category is presented in table 4.7.

Table 4.7: Responses of Students on Access

Statements	SA%	A%	N%	D%	S%	$\chi 2$	D
Access							
17. I use Wi-Fi to learn via online tools	11.7	7.8	7.8	35	37.9	46.9	S
18. There is easy access of internet in my community	1.9	5.8	13.6	40.8	37.9	67.9	S
19. I use mobile data to learn mathematics	26.2	56.3	3.9	11.7	1.9	103.6	S
20. 4 G network is available in my community	10.7	3.9	5.8	13.6	40.8	68.7	S
21. Using mobile data in learning through online is more expensive	60.2	22.3	1.9	11.7	3.9	117.2	S
22. All of my friends are connected with my teacher in our online class	1.9	5.8	5.8	36.9	49.5	97.1	S
23. I use internet to search learning materials	0.0	7.8	5.8	33.0	53.4	63.3	S
24. There is no problem of fluctuation of internet.	4.9	5.8	5.8	40.8	42.7	81.3	S

As analyzed in table 4.7, statement 17 is significant with $\chi 2$-value 46.9. This means the statement is good. Less than one fifth of the students agree or strongly agree with statement 17 but more than 70% of the students disagree or strongly disagree with it. This concludes most of the students do not use Wi-Fi to learn via online tools. That means very few numbers of students only have access with Wi-Fi. Similarly, $\chi 2$-value of

statement 18 is 67.9; which is significant. This means statement preserves the goodness. Only 7.7% of the students responded agree and strongly agree for statement 18 but nearly 18% of the students responded disagree and strongly disagree on it. That means most of the students rejected the view of the statement. This concludes there is no easy access of internet in their community. Likewise, $\chi 2$-value of statement 19 is 103.65, which is highly significant. 82.5% of the total students agree and strongly agree with statement 18 but very few numbers of students only disagree on it. This concludes most of the students use mobile data to learn mathematics via online. Statements 20, 21, 22 and 23 are significant with $\chi 2$-values 68.69, 117.24, 97.05 and 63.25 respectively. Nearly 80% of the students disagree and strongly disagree with statement 20. This means most of the students have no 4 G network available in their community. Similarly, more than 80% of the total students agree and strongly agree with statement 21 but very few numbers of teachers responded disagree and strongly disagree on it. This concludes that most of the students agree that using mobile data in learning through online is more expensive. Only 7.7% of the total students responded agree and strongly agree for statement 22 but 86.4% of the total students responded on disagree and strongly disagree. This means almost of the students disagree statement 22. This concludes all of their friends are not connected with their teacher in online class. They do not have access of internet, they do not have device like mobile, laptop etc. No student has strongly agreed with statement 23. But, 86.4% of the students disagree and strongly disagree with statement 23. This means they do not use internet to search learning materials. Moreover, statement 24 is significant with $\chi 2$-value 81.32. Only one tenth of the total students agree and strongly agree with statements 25, where as 83.5% of the total students disagree and strongly disagree with

this statement. This concludes most of the students responded there is problem of fluctuation of internet in their community.

From this above analysis, the researcher has found that most of the students have no easy access of internet in their community. They use mobile data to learn mathematics via online, but there is lack of 4 G network. There is problem of fluctuation of internet. So, many of their friends are not connected with their teachers in their online class, it is because mobile data is more expensive. And those students having Wi-Fi also do not use to search learning materials.

Effectiveness. Effectiveness is the fourth dimension among four dimensions. Statements 25 to 32 are related to effectiveness. Effectiveness includes student's achievement, interest, evaluation, time to complete the course etc. This table consist the attitudes of students on Effectiveness in teaching and learning mathematics through online. The result under this category is presented in table 4.8.

Table 4.8: Responses of Students on Effectiveness

Statements	SA%	A%	N%	D%	S%	$\chi 2$	D
Effectiveness							
25. Learning mathematics is more effective via online tools	1.9	7.8	11.7	35	43.6	92.8	S
26. Online tools help to increase student's achievement	3.9	7.8	3.9	42.7	41.7	85.4	S
27. Using online tools make the students understand mathematics	3.9	9.7	3.9	29.1	53.4	93.9	S

	more							
28.	Online tools are more effective than face to face mode.	1.9	11.7	3.9	40.8	41.7	80.4	S
29.	Online tools increases my interest in learning mathematics	3.9	9.7	13.6	33.0	39.8	49.9	S
30.	I may not get teacher's feedback while learning mathematics through online.	39.8	40.8	1.9	7.8	9.7	72.4	S
31.	Learning mathematics through online lengthen the time to complete the course	50.5	41.7	1.9	3.9	1.9	119.18	S
32.	Using online tools in teaching mathematics can not address the weak students	48.5	41.7	1.9	5.8	1.9	110.3	S

As analyzed in table 4.8, statement 25 has $\chi 2$-value 92.78; which is significant. This means statement 25 preserves the goodness. Less than one tenth of the total teachers agree and strongly agree with statement 25 but more than three fourth of the total teachers responded on disagree and strongly disagree. This concludes most of the students responded that learning mathematics is less effective via online tools. Similarly, statements 26, 27, 28, 29 and 30 have $\chi 2$-values 85.39, 93.94, 80.35, 49.86 and 72.38 respectively. That means these statements are significant and they preserves the goodness of the statements. Nearly one tenth of the total students agree and strongly agree with statement 26 but 84.4% of the students responded on disagree and strongly disagree on it. That means most of the students do not agree that online tools help to increase student's achievement. Likewise, more than 80% of the students disagree and strongly disagree

with statement 27. This concludes that using online tools do not make students understand mathematics more. Furthermore, only 13.6% of the students responded agree and strongly agree for statement 28 but 82.5% of the students disagree and strongly disagree on it. This means most of the students views that face to face mode is more effective than online mode in teaching and learning mathematics. Likewise, about one tenth of the students responded on agree and strongly agree for statement 29, where as more than two thirds of the students responded on disagree and strongly disagree. This means most of the students agreed that online tools do not increase their interest in learning mathematics. Similarly, more than 80% of the students voted on agree and strongly agree for statement 30. Very less students only responded on disagree and strongly disagree. This implies most of the students agreed that they do not get teacher's feedback through online mode teaching. Moreover, statements 31 and 32 are highly significant with $\chi 2$-values 119.18 and 110.25 respectively. This preserves the goodness of these statements. 92.2% of the students responded on agree and strongly agree for statement 31 but only 5.8% of the students disagree and strongly disagree. This implies maximum number of the students agree on the statement "Learning mathematics through online lengthen the time to complete the course". Similarly, more than nine tenth of total students responded on strongly agree and agree for statement 32 but very few numbers of students disagreed on it. This means almost of the students viewed that using online tools in teaching and learning mathematics can not address the weak students.

From this above analysis, the researcher has found that learning mathematics via online tools is not effective. Online tool doesn't help to increase student's achievement. Face to face mode is more effective than online mode in learning

mathematics. Online tools only lengthen the time to complete the course as well as it can't address the weak students.

Comparison of Institutional and Public School's Teachers Attitudes on Teaching and Learning Mathematics Using Online tools

The researcher had found the attitudes of institutional and public school's teachers on using online tools in teaching and learning mathematics on the basis of obtained data from secondary school's mathematics teachers which were analyzed and interpreted above. To identify the second objective obtained data were divided into category, as institutional and public schools. The second objective of this study was to compare the community and institutional schools' teachers and students' attitudes on using online tools in teaching and learning mathematics. To compare the institutional and public schools' teachers' attitudes on using online tools, mean, SD and t-value were computed, tabulated and analyzed in table 4.9.

Table 4.9: Mean, Standard Deviation and t- Value of Public and Institutional Schools' Teachers

Comparison	**N**	**Mean**	**SD**	**Calculated value**	**t-value**	**Decision**
Institutional Teachers	21	4.0	0.607	0.59	2.0106	Significant
Public Teachers	29	3.88	0.697			

N = Sample Size = 50

d.f. = degree of freedom = $N_1+N_2-2 = 21+29-2 = 48$

The table 4.9 shows that there were 21 institutional schools' mathematics teachers and 29 public schools' mathematics teachers. The mean score of institutional school teachers' is 4.0 and public school teachers is 3.88. SD of institutional and public school's teachers were 0.607 and 0.697 respectively with the degree of freedom 48. The calculated t-value with respect to difference of mean score is 0.59 which lies between tabulated values (±2.0106) at 0.05 level of significance. Thus, there is no significance difference between institutional and public schools' mathematics teachers' attitudes on using online tools in teaching and learning mathematics. It is concluded institutional school teachers and public schools teachers both have same attitude on using online tools in teaching and learning mathematics.

Comparison of Institutional and Public School's Students Attitudes on Teaching and Learning Mathematics Using Online Tools

To identify the second objective, obtained data were divided into category, as institutional and public schools. The second objective of this study was to compare the public and institutional schools' teachers and students' attitudes on using online tools in teaching and learning mathematics. To compare the institutional and public schools' students' attitudes on using online tools, mean, SD and t-value were computed, tabulated and analyzed in table 4.10.

Table 4.10: Mean, Standard Deviation and t- Value of Institutional and Public Schools' Students

Comparison	**N**	**Mean**	**SD**	**Calculated Value**	**t-value**	**Decision**
Institutional Students	47	3.874	0.412	0.574	1.98	Significant
Public Students	56	3.827	0.415			

N = Sample Size = 103

d.f. = degree of freedom = $N_1+N_2-2 = 47+56-2 = 101$

The table 4.10 shows that there were 47 institutional schools' students and 56 public schools' students in this survey. The mean score of institutional school students' is 3.874 and public school students' is 3.827. SD of institutional and public school's students were 0.412 and 0.415 respectively with the degree of freedom 101. The calculated t-value with respect to difference of mean score is 0.574 which lies between tabulated values (±1.98) at 0.05 level of significance. Thus, there is no significance difference between institutional and public schools' students' attitudes on using online tools in teaching and learning mathematics. It is concluded that institutional and public school's students both have no difference attitudes on using online tools in teaching and learning mathematics. That is, public school students and institutional schools students both have same attitude on using online tools in teaching and learning mathematics.

Comparison of Teachers' and Students' Attitudes on Teaching and Learning Mathematics Using Online Tools

The second objective of this study was to compare the attitudes of teachers and students on using online tools in teaching and learning mathematics. To compare the mathematics teachers' and students' attitudes on using online tools; mean, SD and t-value were computed, tabulated and analyzed in table 4.11.

Table 4.11: Mean, Standard Deviation and t- Value of Mathematics Teachers' and Students

Comparison	**N**	**Mean**	**SD**	**Calculated Value**	**t-value**	**Decision**
Students	103	3.85	0.41	- 0.985	1.975	Significant
Teachers	50	3.93	0.66			

N = Sample Size = 153

d.f. = degree of freedom = N_1+N_2-2 = 103+50-2 = 151

The table 4.11 shows that there were 103 students and 50 mathematics teachers in this survey. The mean score of students' is 3.85 and mathematics teachers' is 3.93. SD of students' and teachers' were 0.41 and 0.66 respectively with the degree of freedom 151. The calculated t-value with respect to difference of mean score is -0.985 which lies between tabulated values (±1.975) at 0.05 level of significance. Thus, there is no significance difference between mathematics teachers' students' attitudes on using online tools in teaching and learning mathematics. It is concluded that mathematics teachers and

secondary school students both have no difference attitudes on using online tools in teaching and learning mathematics. That is, secondary school students and mathematics teachers both have same attitude on using online tools in teaching and learning mathematics

Chapter V

Summary, Findings, Conclusion and Recommendation

The purpose of this chapter is to present overall summary of the study. The findings of the study are summarized, conclusion is drawn, and some recommendations have been made.

Summary of this Study

Mathematics is one of the core subjecst in school level curriculum in our formal education system. Teaching and learning mathematics is being tougher day by day. Nepal as well as almost of the countries of the world have been extremely affected by this pandemic Covid-19 and almost of the academic institutions are obliged to close their formal teaching learning activities in face to face mode. So, Mathematics teachers and students are seeking different ways of teaching and learning mathematics nowadays. Traditional type of f2f pedagogy is shifting to online learning due to this situation and for other reasons. So, the researcher had tried to study the attitudes of teachers and students on using online tools in teaching and learning mathematics.

The main purposes of this study were to find out teachers' and student's attitudes on using online tools in teaching and learning mathematics and compare their attitudes. The researcher adopted the survey research design for this study. The Likert scale questionnaire was used as tools of the study, which was developed on the basis of conceptual framework. The questionnaire form included 32 statements on the basis of four dimensions: Modes, ICT Knowledge, Access and Effectiveness. The researcher adopted connectivism approach. Connectivism is a theoretical framework for

understanding learning in a digital age. It emphasizes that learning happens through different nodes such as web browsers, search engines, wikis, online discussion forums, social networks, mobile application etc.

50 secondary school's mathematics teachers and 103 secondary schools' students were taken from 10 public schools and 7 institutional schools of Dhading district. The study was limited on Dhading district of Nepal. The five-point rating scale made of strongly agree, agree, neutral, disagree and strongly disagree was adopted to collect data and respondents were asked to indicate their options with the tick mark. The collected data were analyzed by using following statistical tools: Chi Square test at 0.05 level of significance was used to find the responses of teachers and students are significant or non-significant. The percentage of responses was used to find attitudes of teachers and students on using online tools in teaching and learning mathematics. Also, t-test at 0.05 level of significance was used to compare institutional and public school's mathematics teachers and students' practices of ICT tools in teaching and learning mathematics.

Findings of the Study

The major findings of the study were following:

- More than 60% of the total teachers' uses Zoom and Google Meet to teach mathematics via online. Very few number of teachers used Microsoft Team. And about only one fifth of the total teachers considered face book messenger as a tool of online teaching.

- Most of the teachers agreed ICT knowledge is required to teach via online but only ICT is not sufficient. Still one third of the total teachers have not taken ICT training.
- There is no easy access of the internet in the community of teachers. There is fluctuation of internet.
- More than 70% of the teachers stated that online tools do not help to increase interest and achievement of the students. They concluded that evaluating students is difficult through online tools; and it cannot address weak students.
- More than 60% of the students were unknown with Microsoft Team. Maximum number of students used Zoom and Google Meet to learn mathematics via online.
- More than three fourth of the total students do not have ICT knowledge. But, they agreed that ICT provides instructional materials. Likewise, maximum number of students accepted that they can get mathematics information from the internet more than from books.
- Less than 10% of the students have easy access of internet. By the consequences, most of their friends are not connected with them in their online class. Using mobile data is more expensive.
- More than 80% of the total students responded that learning through online tools is less effective than face to face mode. Online tools only lengthen the time to complete the course. And maximum number of students stated that they are unable to get teachers' feedback and guidance via online mode.
- The calculated t-value with respect to difference of mean score is 0.59; which lies between tabulated values (±2.0106). Thus, institutional teachers and public

teachers both have no different attitudes on using online tools in teaching and learning mathematics.

- The calculated t-value with respect to difference of mean score is 0.574; which lies between tabulated values (±1.66). Thus, institutional schools' students and public schools' students both have no different attitudes on using online tools in teaching and learning mathematics.
- The calculated t-value with respect to difference of mean score is -0.985; which lies between tabulated values (±1.975). Thus, mathematics teachers and secondary school students both have no different attitudes on using online tools in teaching and learning mathematics.

Conclusion

On the basis of research findings, the researcher concluded that mathematics teachers and secondary school students have no different attitudes towards using online tools in teaching and learning mathematics. Likewise, institutional teachers and public teachers as well as institutional school students and public school students also have no significance difference in their attitudes towards use of online tools. Similarly, the researcher has concluded that most of the teachers and students have been using Zoom and Google Meet as online tools in teaching and learning mathematics. But, they have no easy access of internet in their community. Similarly, some of the teachers and many of the students have no proper ICT knowledge to use online tools. Furthermore, the researcher concludes that online tools do not increase the interest and achievement of the students. Online tools only lengthen time to complete the course and are not appropriate for evaluating students.

The researcher come to the conclusion that Government of Nepal, MOE, MOCIT, CDC and other concerned bodies should made the policy in online education system. Most of the students and some of the teachers have no proper ICT knowledge, so they should be trained. Likewise, there is no easy access of internet in community, so MOE and MOCIT should provide free access of internet in schools, to teachers and students. And newly advanced online tools should be used to make teaching and learning mathematics more effective.

Recommendations for Education Implication

The conclusion of the study cannot generalize to all areas due to the limitation contained in this study. After analyzing the conclusion, the researcher has prepared the following recommendation for education implication:

- Government of Nepal should develop online tools related mathematics course and provide training for all institutional and public schools' mathematics teachers.
- MOE and CDC should develop effective online tools for teaching and learning mathematics.
- Public and Institutional school's administration should provide free access of internet in their schools, to the students and to the teachers.
- Public school and institutional school both should provide ICT training to their teachers and students.
- This research studied the teachers and students only. Further study is needed in this topic considering the responses of school administration and students' parents also.

- The similar study should be done to find out the attitudes of urban teachers/ students and rural teachers/students towards online tools in teaching and learning mathematics.

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Appendix A

Attitudes of teachers and students on using online tools in teaching and learning mathematics

Respected Teacher,

I am from the Central Department of Mathematics Education, TU, Kirtipur to conduct a research on "Attitudes of teachers and students on using online tools in teaching and learning mathematics". This is for the partial fulfillment of the requirements for the degree of Master of Education. To complete this research, I have prepared some questionnaire which is present to you. This is no right and wrong answer regarding each statement and the decision will be based on your own practices. Researcher is very thankful for your valuable help and would like to express gratitude to you and your institution. The questionnaire data will be kept confidential and only used for the research purpose.

I request to read carefully and respond how as you practice.

You are kindly requested to fill all the questions.

Researcher

Suresh Aryal

deepshikhar999@gmail.com

Personal Details

School's type: …….

Sex: …..…… Job Category (Permanent or Temporary): ……

Qualification: ……..... Teaching level: ……..

Teaching experience …….

Please give tick mark (√) which you feel the best option.

(SA= Strongly Agree, A=Agree, N=Neutral, D=Disagree, and SD=Strongly Disagree)

SN	Statements	SA	A	N	D	SD
A. Modes						
1	Zoom app is useful to teach mathematics.					
2	Google meet is useful to teach mathematics.					
3	Zoom app is best for sharing screen.					
4	Google meet has no time limit bound which helps to extend the class.					
5	Microsoft team is useful to teach mathematics through online.					
6	Face book Messenger is means of teaching mathematics via online.					
7	Microsoft Team is difficult to use.					

8	There are others effective modes of online teaching except Zoom, Google meet, Microsoft team and Face book messenger.					
B. ICT Knowledge						
9	ICT Knowledge is required to teach mathematics through online					
10	ICT makes my lesson more diverse					
11	ICT are not sufficient for teaching concepts of mathematics					
12	ICT provides instructional materials					
13	Using ICT in teaching mathematics via online is difficult job					
14	I can teach mathematical information from the internet more than from books					
15	Using ICT in teaching mathematics demonstrates the mathematical concept to students					
16	I have taken ICT training					
C. Access						
17	I use Wi-Fi to teach my students					
18	There is easy access of internet in my community					

19	I use mobile data to teach my students					
20	4 G network is available in my community					
21	Using mobile data in teaching through online is more expensive					
22	All of my students are connected with me in my online class					
23	I use internet to search learning materials					
24	There is no problem of fluctuation of internet.					
D. Effectiveness						
25	Teaching learning activities is more effective via online tools					
26	Online tools help to increase student's achievement					
27	Using online tools make the students understand mathematics more					
28	Online tools help to encourage the interest of the students					
29	Using online tools motivates students for learning					
30	Online tools help to evaluate the students					
31	Teaching through online lengthen the time to complete the					

	course					
32	Using online tools in teaching mathematics can not address the weak students					

Thanks for your help

Appendix B

Attitudes of teachers and students on using online tools in teaching and learning mathematics

Dear Student,

I am from the Central Department of Mathematics Education, TU, Kirtipur to conduct a research on "Attitudes of teachers and students on using online tools in teaching and learning mathematics". This is for the partial fulfillment of the requirements for the degree of Master of Education. To complete this research, I have prepared some questionnaire which is present to you. This is no right and wrong answer regarding each statement and the decision will be based on your own practices. Researcher is very thankful for your valuable help and would like to express gratitude to you and your institution. The questionnaire data will be kept confidential and only used for the research purpose.

I request to read carefully and respond how as you practice.

You are kindly requested to fill all the questions.

Researcher

Suresh Aryal

deepshikhar999@gmail.com

Personal Details

School's type: …….

Class: ……. Roll Number: …….....

Sex: …..……

Please give tick mark (√) which you feel the best option.

(SA= Strongly Agree, A=Agree, N=Neutral, D=Disagree, and SD=Strongly Disagree)

SN	Statements	SA	A	N	D	SD
A. Modes						
1	Zoom app is useful to learn mathematics via online.					
2	Google meet is useful to learn mathematics.					
3	Zoom app is best for sharing screen to show my homework and class work to my teachers.					
4	Google meet has no time limit bound which helps to extend the class.					
5	Microsoft team is useful to learn mathematics through online.					
6	Face book Messenger is effective means of learning mathematics via online.					
7	Microsoft Team is difficult to use.					
8	There are others effective modes of online learning except					

	Zoom, Google Meet, Microsoft team and Face book messenger.					
B. ICT Knowledge						
9	ICT Knowledge is required to learn mathematics through online					
10	ICT knowledge helps me to learn mathematics more effectively					
11	ICT are not sufficient for understanding concepts of mathematics					
12	ICT provides learning materials					
13	Using ICT in learning mathematics via online is difficult job					
14	I can get mathematical information from the internet more than from books					
15	Using ICT in teaching and learning mathematics demonstrates the mathematical concept to students					
16	I have proper ICT knowledge					
C. Access						
17	I use Wi-Fi to learn via online tools					

18	There is easy access of internet in my community					
19	I use mobile data to learn mathematics					
20	4 G network is available in my community					
21	Using mobile data in learning through online is more expensive					
22	All of my friends are connected with my teacher in our online class					
23	I use internet to search learning materials					
24	There is no problem of fluctuation of internet.					
D. Effectiveness						
25	Learning mathematics is more effective via online tools					
26	Online tools help to increase student's achievement					
27	Using online tools make the students understand mathematics more					
28	Online tools are more effective than face to face mode					
29	Online tools increases my interests in learning mathematics					
30	I may not get teacher's feedback while learning mathematics through online mode					

31	Learning mathematics through online lengthen the time to complete the course					
32	Using online tools in teaching and learning mathematics can not address the weak students					

Thanks for your help

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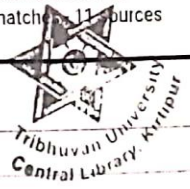

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ATTITUDES OF TEACHERS AND STUDNETS ON USING ONLINE TOOLS IN TEACHING AND LEARNING MATHEMATICS A THESIS BY SURESH ARYAL IN THE PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER'S DEGREE IN EDUCATION SUBMITTED TO DEPARTMENT OF MATHEMATICS EDUCATION CENTRAL DEPARTMENT OF EDUCATION UNIVESITY CAMPUS, KIRTIPUR TRIBHUVAN UNIVERSITY KATHMANDU, NEPAL 2022 i lqe'jg ljZjljBfno lzlff zf:q s]Gb|Lo ,+sfo ul0ft lzlff ljefu TRIBHUVAN UNIVERSITY CENTRAL DEPT. OF EDUCATION DEPARTMENT OF MATHEMATICS EDUCATION kq ,+Vof M ldlt:..... Ref.: Date:..... Letter of Certification This is to certify to Suresh Aryal a student of academic year 2072 / 073 with campus Roll No. 360, Exam Roll No. 7228408, thesis number ..... and T.U. Regd. No. 9- 2-375-247-2009 has completed his thesis under supervision of Mr. Krishna Prasad Adhikari during the period prescribed by the rules and regulations of Tribhuvan University, Nepal. The thesis entitled "Attitudes of teachers and students on using online tools in teaching and learning mathematics" has been prepared based on results of his investigation. I, here by recommend and forward that his thesis be submitted for evaluation as the partial requirements to the degree of Master of Mathematics Education ..... Date: ..... Prof. Dr. Bed Raj Acharya (Head) ii lqe'jg ljZjljBfno lzlff zf:q s]Gb|Lo ,+sfo ul0ft lzlff ljefu TRIBHUVAN UNIVERSITY CENTRAL DEPT. OF EDUCATION DEPARTMENT OF MATHEMATICS EDUCATION kq ,+Vof M ldlt:..... Ref.: Date: ..... Letter of Approval A Thesis By Suresh Aryal Entitled "Attitudes of teachers and students on using online tools in teaching and learning mathematics" submitted by Mr. Suresh Aryal in partial fulfillment of the requirement for the Master's Degree in Education has been approved. Viva-Voce Committee Prof. Dr. Bed Raj Acharya (Chairman) ..... (External) Mr. Krishna Prasad Adhikari (Member) Date: ..... Signature .... iii iv lqe'jg ljZjljBfno lzlff zf:q s]Gb|Lo ;+sfo ul0ft lzlff ljefu TRIBHUVAN UNIVERSITY CENTRAL DEPT. OF EDUCATION DEPARTMENT OF MATHEMATICS EDUCATION kq ,+Vof M ldlt:..... Ref.: Date: ..... Recommendation for Acceptance This is to certify that Mr. Suresh Aryal has completed his M. Ed. thesis entitled "Attitudes of teachers and students on using online tools in teaching and learning mathematics" under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva- voice. ..... Mr Krishna Prasad Adhikari (Supervisor) v Defense Date: ..... vi Dedication Honestly dedicated To My parents Father Tanka Prasad Aryal and Mother Padam Kumari Aryal vii Declaration This dissertation contains no material which has been accepted for the award of other degree in any institutions. To the best of knowledge and belief this dissertation contains no material previously published by any authors except due acknowledgement has been made. Date: ..... Suresh Aryal viii Acknowledgment The journey of this research would not have been possible without cooperation, warm support and accompany of many others. I would like to extend my first and foremost, gratitude and sincere