PRACTICES OF ICT IN TEACHING AND LEARNING MATHEMATICS

A

THESIS

BY

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FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE

DEGREE OF MASTER OF EDUCATION

SUBMITTED

TO

DEPARTMENT OF MATHEMATICS EDUCATION

CENTRAL DEPARTMENT OF EDUCATION

UNIVERSITY CAMPUS, KIRTIPUR

TRIBHUVAN UNIVERSITY

KATHMANDU, NEPAL

2019

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शिक्षा शास्त्र केन्द्रीय संकाय
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Recommendation for Acceptance

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……..

Mr. Krishna Prasad Adhikari

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Letter of Approval

A

Thesis

By

Bhanu Bhakta Adhikari

Entitled

"**Practices of ICT in Teaching and Learning Mathematics**" submitted by Mr. Bhanu Bhakta Adhikari in partial fulfillment of the requirement for the Master's Degree in Education has been approved.

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Letter of Certification

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Date: Aug 11, 2019

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Dedication

Honestly dedicated

To

My parents

Father Hari Prasad Adhikari and Mother Bhuwan Maya Adhikari

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: ……

Bhanu Bhakta Adhikari

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 thanks to my respected supervisor Mr. Krishna Prasad Adhikari, lecturer of Department of Mathematics in Central Department of Education T.U, for his valuable suggestion, constructive criticism and intellectual support bestowed on me scarifying his valuable time.

I would like to express my sincere gratitude to Associate Prof. Laxmi Narayan Yadav, Head of Department of Mathematics Education for managing such wonderful platform and co-operative environment. It is worth appreciating all the Respondents' teachers, Head teachers and students of my sample schools of Dhankuta district. I would like to express my deep gratitude to the Prof. Dr.Min Bahadur Shrestha, Prof. Dr. Binod Prasad Dhakal, Prof. Dr. Eka Ratna Acharya, Prof. Dr. Bed Raj Acharya, Lecturers Abatar Subedi, Bed Prasad Dhakal, Hom Kumari Adhikari, Dr. Ganesh Adhikari, Loknath Bhattarai, Dipak Mainali, Sarala Luitel and all my respective teachers under the Department of Mathematics in Education at T.U. Kirtipur for their valuable guidance. Furthermore, I would like to acknowledge my brother Chhagendra Adhikari for his continues support and creating congenial environment at home and my all friends for their kind support during my academic journey. Last but not least, I must thank my family members who were the constant sources of inspiration of my work.

……..

Bhanu Bhakta Adhikari

Abstract

This study entitled “practices of ICT in teaching and learning mathematics.” The propose of this study is to identity teachers and students’ practices of ICT tools in teaching and learning mathematics and to compare community and institutional mathematics teachers and students’ practices of ICT tools in teaching and learning mathematics. The data were collected by administrating questionnaire to 46 secondary school’s mathematics teachers and 146 students (from 15 community and 8 institutional secondary schools) of Dhankuta district by stratified random sampling method. The survey design was conducted to achieve the objectives of study. The questionnaire was prepared on the basis of four dimensions (social media, online resources, mobile application and mathematical software). The practices of mathematics teachers and students were measured in five-point rating scale. The collected data was tabulated and analyzed by using SPSS software version 21.0 to get the value of statistics 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 found that secondary schools’ mathematics teachers and students has minimum practices of ICT tools in teaching and learning mathematics. It is concluded that community and institutional secondary school’s mathematics teachers has no significance difference in practices of ICT tools in teaching and learning mathematics. Likewise, community and institutional secondary schools’ students has significance difference practices of ICT tools in learning mathematics. This shows that community schools students have better practices of ICT tools than institutional schools’ students in learning mathematics.

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Chapter I

Introduction

Background of the Study

According to Daniels (2002) Information Communication Technology (ICT) have become within a very short time, one of the basic building blocks of modern society. Many countries now regard understanding ICT and mastering the basic skills and concepts of ICT as part of the core of education, alongside reading, writing and numeracy. However, there appears to be a misconception that ICTs generally refers to ‘computers and computing related activities. This is fortunately not the case, although computers and their application play a significant role in modern information management, other technologies and/or systems also comprise of the phenomenon that is commonly regarded as ICTs.

The field of education has been affected by ICTs, which have undoubtedly affected teaching, learning, and research. A great deal of research has proven the benefits to the quality of education. ICTs have the potential to innovate, accelerate, enrich, and deepen skills, to motivate and engage students, to help relate school experience to work practices, create economic viability for tomorrow's workers, as well as strengthening teaching and helping schools change. Computers and applications of technology became more pervasive in society which led to a concern about the need for computing skills in everyday life (Jhurreev,2005).

ICT increases the flexibility of delivery of education so that learners can access knowledge anytime and from anywhere. It can influence the way students are taught and how they learn as now the processes are learner driven and not by teachers. This in turn would better prepare the learners for lifelong learning as well as to improve the quality of learning. In concern with geographical flexibility, technology-

facilitated educational programs also remove many of the temporal constraints that face learners with special needs. Students are starting to appreciate the capability to undertake education anywhere, anytime and anyplace.

ICT tools are online/offline technology platforms that help to connect people together far and near. It is used to build relationship among people. The use of ICT tools by students and teacher helps to have access to basic information as quick as possible. In school, the use of online platform such as school website will give students the right access to quality information about school environment, department, rules and regulation. It has been observed that ICT tools has a wider and faster means of circulating information not only to the students of an institution but also to the generality of the public. Students must use all available online platforms effectively and they must be conscious of ICT tools positive and negative effects they should try as much as possible to create a balance so as not to get carried away while learning.

The ICT tools also have numerous positive impact and effects. Firstly, at enhance learning and education. Students, with the help of internet noun have asses to all form of information. Nothing is strange to google. No matters how old the information is, the internet serves have searchlights to them. Some information cannot be found in the libraries and research centers are now available online. The use of search engine such as google and google scholar has help many students in their educational life. The world is now a small place where there is a circulation of knowledge and information. Educational problems encountered by students are being discuss and solved online with the help of online counselors. Secondly distance learning is made possible using CT tools. Many universities are now offering online courses to the public. The ICT tools has brought education and learning to our

doorsteps. No need for travelling and risking lives just to study (Ibrahim, N. 2016, November 15th).

ICT tools are becoming the most important tools for interaction among people, where everybody can share, exchange, comment, discuss and create information and knowledge in a collaborative way. ICT tools are rapidly changing the communications landscape, their emergence has impacted significantly how students learn and the way instructors teach. In today higher education settings, instructors, students and others collaborate on the tasks of knowledge construction. The main aim of the paper is to find the gap of knowledge in adoption of social network sites in teaching and learning process in formal sites that can efficiency definition of ICT tools is "the relationships that exist between network of people." The influence of ICT tools on teaching learning environment is growing every year and its applications can reinforce class materials, positively influenced discussions, collaborative work, etc. The educators and researchers experimenting the ICT tools technologies to knowledge constructions and thinking skills. The increasingly widespread use of social network sites to expand and deepen one's social connections is a relatively new but potentially important phenomenon that has implications for teaching and learning and teacher education in the 21st century. The applied in educational system and provides direction for subsequences researches and as a guideline for future research in social network sites in education.

The use of ICT tools in education can enhance meaningful learning better than the traditional classroom instructions. "they can engage a wider range of intelligence, connecting school with real world, supporting integration, offering dynamic displays, multiple and linked representations, interactive models and simulation and the storage and retrieval of multiply categorized information" (Ashburn and Flodden, 2006, p.28).

The ICT tools refers to the use of web-based and mobile technologies to turn communication into an interactive dialogue. ICT tools takes many different forms, web blogs, micro blogging, wikis, products, photographs or pictures video and social bookmarking etc. With world in the modest of the ICT tools revolution, it is more than obvious that ICT tools like Facebook, Google, YouTube, Gmail are used extensively for communication. This form of communication can be with a person or a group of people. Today most of the people specially the younger are hooked on to the different ICT tools for keeping in contact with their peers. ICT tools is media for social interaction as a super set beyond social communication. There are pros and cons to the ICT tools. One most important advantage is the online sharing of knowledge and information among the different group of people. This online sharing of information also promotes the increase in the communication skill among the student and teacher specially among the learners /students of teaching and learning procedure.

According ICT master plan of Nepal it is realized that ICT in education is important as a result some policies have been identified and some activities related to ICT have been carried out. ICT and computer education courses have been offered in general as well as technical educations. For example, National Center for Educational Development (NCED) has been providing training to the teachers through national radio and FM; computer engineering/computer science/ICT programmer in bachelor's and master's level are run by different college under various Universities. MOE has implemented some of the program related to ICT in education. They are: one laptop per child (OLPC) pilot project in selected 26 school of six district's; lab model (computer sharing mechanism) project in some schools and internet connectivity to district education office (DEOS) and schools (through matching fund to schools) and

computer labs with internet connection from local ISPs. Similarly, central level agencies under MOE, five regional directorates (REDS) and 75 District Education Office have lunched their web sites. Department of Education (DOE), with the involvement of some NGOs, has developed interactive digital learning materials for the students of grades 2 to 6 in Nepali, Mathematics, English and Social subjects.

Statement of the Problem

The impact of ICT tools and technology have been shrinking the world as global village. In this situation ICT tools and technology highly influencing on education system. It also impacts on teaching and learning in school education. In Nepalese context most of the people have negative impression on mathematics as abstract subject. To encounter negative impression and for effective mathematics teaching and learning ICT master plan of Nepal have been carried out some policies related to ICT. Tribhuvan University designed and implementing ICT course in Mathematics Education since 2070. But I was unknow about ICT tools and technology because of lack of knowledge and lack of such advance social technology and tools. When I joined Master's Degree in Tribhuvan University I had got chance to take a class with ICT and understands its importance. I understood some features and advantage of ICT tools and got a chance for power point presentation in classroom. This opportunity opens my eyes to learning mathematics form ICT tools and technology. After complication of fourth semester examination I have been teaching on government school. I faced many problems in classroom teaching to solve such problems I used ICT tools (online resources, social media, mobile apps, software etc.). This way had very effective for me to solve many mathematical problems. That's why this area as my research study. Thus, researcher proposed to seek the answer of the following research questions;

- How do secondary school's mathematics teachers' practices ICT tools in teaching and learning mathematics?
- How do secondary school's students' practices ICT tools in learning mathematics?
- Are there same practices of ICT tools among community and institutional school mathematics teachers in teaching mathematics?
- Are there same practices of ICT tools among community and institutional school students in learning mathematics?

Objectives of the Study

The objectives of this study are following:

- To identify teachers and students' practices of ICT tools in teaching and learning mathematics.
- To compare community and institutional school's mathematics teachers and students' practices of ICT tools in teaching learning mathematics.

Significance of the Study

The significance 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 identify or describe a concept or to explain or predict a situation or solution to a situation that indicates the type of study to conducted (Buckingham,1974)

Many researchers concluded that ICT can lead to improved students learning in better teaching methods. This research investigates that importance of ICT tools in teaching learning mathematics.

The significance of this study as follows;

- It is useful for teachers to know the motivations, encouragements and achievement of students on practices of ICT tools in teaching and learning mathematics.
- It is useful for students to know the role of ICT tools in learning mathematics.
- It is useful for subject export and curriculum maker to develop ICT related mathematics course of school mathematics.
- It is guideline for school administration and school management committee to developed ICT lab mathematics class in schools.

Delimitation of the Study

The researcher took sample from community and institutional schools' teachers and students of the Dhankuta district. The limitation was as follow;

- In this chapter ICT tools means social media (YouTube, Facebook/messenger), online resources (Gmail, Google), mobile application and mathematical software (GeoGebra, Midas Class).
- This study was limited on Dhankuta, district of Nepal.
- The sample of the study were 46 teachers and 146 students separately.
- This study was based on quantitative research design.

Definition of Key Terms

Definition of key terms consist such definition of words/terms which were used in this research. The key words and their definition are as follows;

ICT. The term ICT stands for information communication technology. In embraces range of technical media from hardware (computer, mobile phones, projection technology, data logging and digital audio and visual equipment's), software application (generic software & multimedia resource) to information system (internet, cloud computing).

Practices. In this study the definition of the words practices means ICT tools used by teachers and students for teaching and learning mathematics.

Community school. In this research community school define as the schools which are established and sponsored by government.

Institutional school. In this research institutional school define as the school which are established and administration by private sector.

Teacher. In this study the definition of the words teachers means the person who teach either government school or institutional school in Dhankuta district.

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. Thus, the review of related literature is important and essential for guideline of research planning.

Empirical Review

Empirical review consists the related article, journals, report and previous thesis. The researcher reviewed some literature, which were related to the research topic 'practices of ICT in teaching and learning mathematics'

Shrestha (2015), research intitle "Status of ICT use in teaching/learning mathematics." Purpose of this study was to investigate the use of ICT in mathematics teaching and learning Heartland children's academy. This is a case study approach the researcher take data from only Heartland children's academy. This study was following and evaluative case study by qualitative phenomena. The major tools use for this study were observation and interview. Three mathematics teachers and 20 students from class 7,8,9 & 10 were considered as sample of the study. The researcher was found from his study that there was neither any plan on the use of educational technology tools in mathematics teaching and learning, nor inadequate teachers training on the use of educational technologies. He also found that there was a lack of relevant educational technology tools for schools. There was major reason for the school not to use the educational technology tools in mathematics teaching and learning. However, this tool was sometimes used for other purpose other than mathematics teaching and learning.

Likewise, Sha (2017), conducted a research on the topic "Teacher attitude towards media in teaching mathematics.'' Purpose of this study was to find out the

attitude of community school and institutional mathematics teachers of media in teaching mathematics and compare their attitude. Researcher take the sample of the population of this study was limited to Kathmandu district community and institutional school of secondary level. He takes 30 mathematics teachers from community school and 30 mathematics teachers from institutional school out of 152 and 781 respectively by the sample random sampling method and select 5/5 teachers for interview by purposive sampling technique. The data was collected by interview, questionnaire (based on Likert's scale) and observation. The data analysis procedure was Z-test at 0.05 level of significant, mean, variance, standard deviation and percentage. The research was depending on mixed method design. He concluded that on this research researcher found that both community and institutional schoolteachers have positive attitude of using media in teaching and learning mathematics. He found that from observation their teaching method is somehow different than the traditional teaching method but not completely modern teaching methods. The institutional schoolteacher was found to be more consistencies with using media for teaching than community schoolteacher. And he also concluded that the attitude of teachers of using media was found more positive and motivating which is good sign for teaching and learning mathematics.

Furthermore, Timilsena (2017), research that in the topic "Attitude of teacher towards ICT in teaching Mathematics". On the purpose of find out of attitude of teachers of ICT in teaching mathematics. He follows Vygotsky's constructivist theory of learning depends on prior knowledge linkage with ZPG. The sample were taking 200 mathematics teachers out of 925 from Surkhet District of Nepal. The data collection tools are Questionnaire and interview. The data analysis procedure is chi – square distribution at 0.05 level of significant. He found that most of the school in

Surkhet district has ICT tools and some teacher are use ICT tools in teaching mathematics, but some teacher is don't use ICT materials because lack of knowledge. Finally, he concluded that all mathematics teacher of Surkhet district have positive attitude.

In the same way, Danai (2017), carried out a research entitle "effectiveness of information communication and technology (ICT)in teaching Geometry". The purpose of study was to find out effectiveness of ICT on teaching Geometry at secondary level and compare the achievement of student taught by using tools of ICT and without of ICT. The population was taken from Kathmandu district private school students of grade 9 academic year 2073. The research was experimental, so the researcher takes two equivalent group. One is control (taught by traditional method) group and another is experimental (taught by use of ICT tools) group he was taught 30 days on both schools. After that researcher take exam on both group and the hypothesis were test by using t-teat at 0.05 level of significance. Also, he shows that the given data from pie-chart and graph. The researcher found that from his study. The mean of pretest was less than posttest and the standard deviation of the experimental group was less then control group. The students were more motivated, interested regularly and more concentrate in ICT class. The achievement of the class nine student who were taught without using the tools of ICT achieve better achievement then the student who were taught without using the tools of ICT. Finally, he concluded that the using the tools of ICT is more effective on teaching Geometry.

The same one Saud, (2018), on the research topic "Attitude of students and teachers of using audio-video aids in learning on secondary level at Surkhet district." Purpose of this study was to explore the attitude of students and teachers in using audio-visual aids for teaching learning and to find out the challenges of using the

audio-visual aids in teaching learning. The researcher followed survey research design and total sample population of primary were 100 student and 15 teachers of Surkhet district. The stratified random sampling procedure was followed for the selection of sample population. Where closed ended questionnaire was using to collect data. There were used statistical aids mean, percentage and chi-square test at 0.05 level of significance. The researcher found that from his research that student and teachers were using audio-video for their teaching and learning. The students and teacher had positive opinion in the use of audio-video for teaching and learning and they agreed on use it. He also concluded that students and teachers motivate to learn the subject materials they feel more comfortable, effective and sustainable teaching learning. All students and teacher views were agreed that audio video aids are very useful and higher achievements. In used the audio-video aids to bring change the classroom environment as well as higher motivation support. In his opinion, audio-video aids are very important to change the education and it made effective and long-lasting learning.

From the above research I identify that the new technology and ICT tools are very useful to teaching and learning mathematics in the school/college of Nepal. The technology-based teaching and learning makes better classroom environment as well as higher motivation support. Teacher and students have positive attitude of the media in government and institutional school although the institutional school's teachers and students are highly positive than government school students and teachers.

In the context of world there were many studies in information communication and technology in mathematics. In this way (Bature,2016), This study investigates the role of ICT as a tool for effective teaching and learning of Mathematics in Secondary Schools. The purpose of this study was to explore students and mathematics teachers'

trainees' use of ICT in the teaching and learning of mathematics. The study adopted survey research design and was conducted in Kafur Local Government Area of Katsina State. The target population was the entire students and mathematics teachers in Kafur Local Government. Five out of ten secondary schools in study were randomly selected as a sample. The instrument used was questionnaires for both teachers and students. Simple percentage and chi-square were used to analyze the data. Among the findings are the use of ICT by students improved their performance, problem-solving skill and mathematics achievements. Some recommendations were equally made among which are adequate and qualitative ITC materials and computer laboratories should be made available in all secondary schools.

Similarly, Tomjanovich and Zuko (2016) present a dissertation entitled "The Use of ICT in Teaching Mathematics - A Comparative Analysis of the Success of 7th Grade Primary School Students." The purpose of this study was to examine the impact of the application of ICT tools in teaching primary school mathematics. The student success in mathematics exam in the Linear function unit was evaluated in two groups of 7th grade students of the primary school Josip Juraj Strossmayer in Zagreb, based on their test scores. The first group 90 students attended mathematics classes without ICT tools in teaching (school years 2008/2009 and 2009/2010). The second group 110 students (school years 2012/1013 and 2013/2014) attended mathematics classes with an extensive use of ICT in the teaching process. The first group of students successfully solved 48±26% of the Linear function test while the second group successfully solved 58±26% of the same test. The results showed a significantly higher solving rate in the group of students who attended classes in mathematics where ICT was used in teaching ($p=0.005$). ICT supported mathematics classes, in the example of Linear function unit significantly improved students results

in written exams. The results of this study ICT in teaching mathematics leads to better learning and knowledge acquisition in primary schools.

The same one Ibrahim, (2016), conduct a research on the topics the "Influence of ICT tools in teaching and learning activities." study aims to look at the influence of ICT tools in learning activities. To achieve these objectives, the counterposed the question of how the influence of ICT tools in learning activities. This study uses a quantitative approach to the form of survey research. The data obtained through questionnaires, documentary studies, and literature study as supporting data. Researchers revealed that there was a significant effect of the use of ICT tools in learning activities. In concrete, forms of ICT tools are commonly used in teaching and learning activities are blogs and yahoo mail. Blog is short for web log which means it is a form of application / web service created to allow a user to publish information it holds through the writings contained in a posting. While Yahoo mail is a provider of electronic mail (webmail) from Yahoo!. It is the largest provider of electronic mail on the Internet, with millions of users. To take advantage of blogs in teaching and learning activities i.e. filling out a menu on the blog with lesson materials to format text, images, audio or video, resulting in a good interaction between teachers and students. The conclusion of the study, teaching and learning activities teachers can position themselves to get closer to the students without borders and distance, besides the students more active and independent in learning activities. This shows that ICT tools is very influential in teaching and learning activities.

There were so many researches in topics ICT tools. From above research teachers and students are more positive and benefited in teaching and learning mathematics using tools and technique of ICT tools. I did not get the research/thesis about "practice of ICT tools in teaching and learning mathematics." ICT tools is new

dimension for teaching and learning aspect, so I'm interested to study about practice of ICT tools in teaching and learning mathematics. To fulfill my partial fulfillment of master's degree course of TU.

Theoretical Review

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). A theory plans and directs the research studies. Any philosophies must be supported by any theory for its pedagogical implementation. Likewise, the Use of ICT supported by Constructivism theory. Here researcher has discussed in brief about Constructivism theory.

The word "construct" is to build or make something. We always use this word in our daily life. In the field of education, "construct" means to develop an idea or a belief that is based on various pieces of evidence which are not always true. Many theories/approaches have been introduced in teaching/learning field. "Constructivism" has also developed as a philosophy in different discipline. It has become a strong means in teaching/learning approach. This point of view maintains that people actively construct new knowledge as they interact with their environment. Constructivist theory of learning believes that the knowledge can be developed within the classroom, being participated in different activities, using different learning agents and through different meaning making processes. One of the key assumptions of constructivism is that "Knowledge is symbolically constructed by the learners who are making their own representations of action" (Gagnon et al.). The guideline principle of constructivist learning theories is the learner's own active initiative and control in learning, and personal knowledge construction that is self- regulation of learning (Chan, 2002, p. 3). Most of the educators utilizing a constructivist

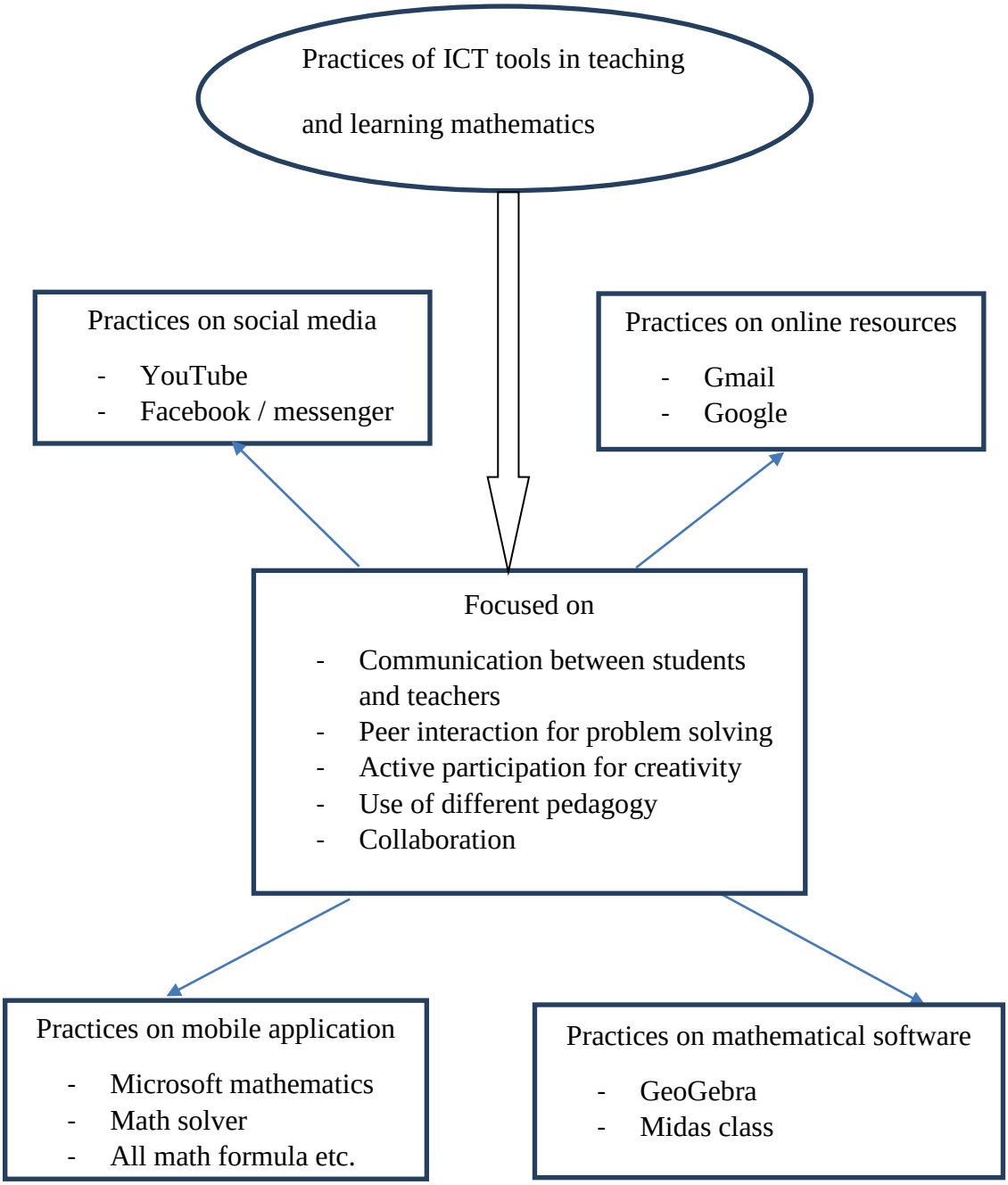
perspective may emphasize an active learning environment that may incorporate learners centered and problem based learning in which students are actively engaged in critical thinking activities so Use of ICT in classroom is based upon the assumptions of constructivism where teachers should play role of instructor and students are actively participate in classroom. In constructivist classroom student tries to find the solution of the problems by learning in a group where students are motivated to do their work themselves and find the solution and teacher work are just to facilitate the student. By using ICT in math classroom student will develop their knowledge by visualizing and here teacher role is just as a facilitator. Further, in this type of constructivist class student are motivated to share their ideas, expand their knowledge through ICT or by utilizing their experiences. ICT supports constructivist pedagogy where students use technology to explore and reach an understanding of mathematical concepts where it promotes higher order thinking and better problem-solving strategies (lttigson&Zewe, 2003 as cited in Keong, Horani& Daniel 2005).

The use of ICT in classroom is based upon the assumptions of constructivism where teachers should play role of instructor and students are actively participate in classroom. Furthermore, in constructivist class students are motivated to share their ideas, experience and expand their knowledge through ICT tools. Thus, Constructivism theory is applicable to my research study.

Conceptual Framework

According to German, P. & Sasse, C.M. (1997), conceptual framework is written or visual representation that "explain either graphically or in written form, main things to study-the key factors, concept or variables and the presumed relationship among them."

In making conceptual framework I took an idea for my topics "Practice of ICT tools in teaching and learning mathematics." From previous thesis done by Sudesh Kumar Sah. The following was conceptual framework in my research.



From above review of literature and theoretical model, researcher has come to the point that on the topic practices of ICT tools in teaching and learning

mathematics. To achieve the objectives of this study researcher tried to identify the practices of community and institutional secondary school's mathematics teachers and students based on ICT tools (on Online resources, social media, mobile apps, and mathematical software) in teaching and learning mathematics. The Questionnaire were developed on the basis of rating scale and then their responses were compared.

Chapter III

Methods and Procedures

"The proper methodological dimensions should also discuss why the data gathering (and analysis, and interpretation) was taken in this manner. In other words, what are the philosophical and intellectual foundations of this particular research practice?" (Madden, 2009).

This chapter 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 sciences is survey research. 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 (cited Muijs, 2004). 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 conducted to obtain the objectives and collect the data by face to face way. Therefore, the survey research design is suitable for this research study. So, survey research design was used to attain the objective of this study.

Population of the Study

There are 73 community and 40 institutional schools in Dhankuta district (Education Development and Coordination Unit, 2076) The population of this research were taking all the mathematics teachers and students of 73 community and 40 institutional schools at Dhankuta district.

Sample of the Study

For the selection of sample researcher was used stratified random sampling methods. Total schools of Dhankuta district were divided into two strata as: community and institutional schools. The researcher took 15 community and 8 institutional secondary school out of 73 community and 40 institutional schools. Thirty mathematics teachers out of total community and 16 teachers out of total institutional school mathematics teachers, 90 community school's students and 56 institutional schools' students were selected by stratified random sampling methods.

Tools of Data Collection

To fulfill the objectives of this study questionnaire were the measure tool for data collection.

Questionnaire. Questionnaire is an important tool for data collection in this research. The researcher had prepared a set of questionnaire on the basis of conceptional framework with four dimensions as social media (You Tube, Facebook/messenger), online resources (Gmail, Google), mobile application (Microsoft mathematics, malMath, math's solver, High school math All math formula etc.) and mathematical software (GeoGebra, Midas Class). It was designed as 5-point rating scale.

Reliability and validity of Tools

For the reliability of the instruments, researcher conducted a questionnaire form based on conceptual framework. To ensure the validity of instruments, the researcher consulted with thesis supervisor. Reliability concerns to degree to which a measuring instrument gives similar results over number of repeated trials. So, the researcher ensured reliability of instruments by taking pilot study test in Sunsari district among five community and five institutional mathematics teachers. Similarly, among five community students and five institutional students. The obtained data were calculated by using Statistical Package for Social Sciences (SPSS) programmer, version 21.0, setting at 0.05. The Cronbach's α was found 0.79(>0.60) on questionnaire of teachers and 0.81 was found on questionnaire of students, which are highly reliable for each statement.

Data Collection Procedure

After selecting the sample and conducting the questionnaire the sample school administration was requested to take out the required data by the help of letter of department. Researcher got the permission to collect data and then the data collection procedure was started.

The researcher prepared the required instrument for data collection. The sample school was randomly selected by simple random sampling, depends upon the teachers and students' practices of ICT in teaching and learning mathematics for secondary level. The teachers and students of both community and institutional secondary schools were given questionnaire and their response was evaluated on the basis of five-point rating scale.

Scoring Procedure

The researcher collected data from sample and then data was tabulated by using following 5-point rating scale.

Table No. 3.1; The scoring procedure on the topic Practice of ICT tools in teaching and learning mathematics.

Meaning Scales	Scores
Always (at least one time in a day)	5
Frequently (at least two or three times in a week)	4
Sometime (at least one times in a week)	3
Rarely (at least two times in a month)	2
Never (at least one time in six month)	1

Weightage of 5, 4,3,2 & 1 to a statement if the response is "Always", 'Frequently', "Sometime", "Rarely" & "Never" respectively for each statement.

Procedure of Data Analysis

This is the survey research design. It is based on quantitative nature. The data obtained by above process was analyzed by statistical package for social science (SPSS) software version 21.0. Total 41 statements are conducted under practices in social media (YouTube and Facebook/ messenger), practices in online resources (Gmail and Google), practices in mobile application and practices in mathematical software (GeoGebra and Midas class) respectively. To find the teachers and students practices of ICT tools in teaching and learning mathematics, percentage and the chi-square value were computed for each statement at 0.05 level of significance and for second objective to compare the community and institutional secondary school's

mathematics teachers and students' practices of ICT tools, mean and standard deviation were calculated by using t- test at 0.05 level of significance.

Chapter IV

Analysis and Interpretation of Data

This chapter deals about statistical analysis and interpretation of collected data related to practices of ICT 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 0.05 level of significance. For analyzing the data, percentage and chai-square test were calculated. The collected data were analyzed under the following headings, correspondence to the objectives of the study.

- Teachers practices of ICT tools in teaching and learning mathematics.
- Students' practices of ICT tools in learning mathematics.
- Comparison of Community and Institutional secondary school's mathematics teachers' practices of ICT tools in teaching and learning mathematics.
- Comparison of Community and Institutional secondary school's students' practices of ICT tools in teaching and learning mathematics.

Teachers Practices of ICT Tools in Teaching and Learning Mathematics

To achieve the first objectives of study, 46 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; social media, online resources, mobile applications and mathematical software. The analysis and interpretations of each category is presented separately in the succeeding sections.

Social Media. Social media is first dimension among four dimensions. Statement one to eight are related to YouTube and statement nine to 13 are related to Facebook/messenger. This table consist the response of secondary schools'

mathematics teachers practices of social media in teaching and learning mathematics. The result under this category is presented in table 4.1.

Table 4.1 Response of secondary school's mathematics teachers on social media

Statement	A* %	F* %	S* %	R* %	N* %	χ^2	D*
YouTube							
1. I use YouTube.	37	28.3	30.3	0	4.3	25.5	S
2. I use YouTube for learning mathematics.	17.4	37	34.8	2.2	8.7	22.0	S
3. I use YouTube to self-preparation for teaching and learning mathematics.	15.2	30.4	28.3	17.4	8.7	7.69	NS
4. I use YouTube to understand mathematical concept.	21.7	30.4	30.4	8.7	8.7	10.95	S
5. I use YouTube for downloading document related to content.	8.7	32.6	39.1	8.7	10.9	19.87	S
6. I demonstrate YouTube video in my classroom by projector.	0	15.2	13	26.1	45.7	26.82	S
7. I refer to my student to watch YouTube for mathematics learning.	21.7	23.9	17.4	6.5	30.4	7.26	NS
8. I use YouTube to bring new idea and pedagogy for teaching and learning mathematics.	26.1	34.8	23.9	2.2	13	14.65	S

Facebook/messenger							
9. I use Facebook/messenger.	73.9	13	10.2	0	2.2	86.39	S
10. I use Facebook/messenger for mathematics learning.	17.4	26.1	39.1	6.5	10.9	15.52	S
11. I use Facebook/messenger to share mathematical problems and their solution.	4.3	23.9	47.8	10.9	13	26.82	S
12. I communicate in Facebook/messenger with my friends to solve mathematical problems.	10.9	19.6	47.8	13.0	8.7	23.78	S
13. I refer to my student to communicate, share and encounter mathematical problems with teacher and friends.	8.7	37	21.7	13	19.6	10.73	S

A*=Always, **F***=Frequently, **S***=Sometimes, **R***=Rarely, **N***=Never 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 χ^2 -value of statement one is 25.55 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 half teachers responded on always and frequently practices. It concludes that almost teachers always and frequently used YouTube. Moreover, table shows that Statement 2 is significant with χ^2 -value 22.6, means this statement preserves goodness of questionnaire. A total of above 50% teachers responded on always and frequently

practices but least number of teachers responded on sometimes, rarely and never practices. This result indicates that most of the teachers used YouTube for learning mathematics. Also, the statement 3 is non-significant with χ^2 -value 7.69. that means the chi square value lies on critical region. Thus, this statement did not preserve goodness of questionnaire. A total of nearly half percent's teachers responded on always and frequently practices, one third of teachers responded on sometimes practices and nearly one third of total teachers responded on rarely and never. This indicates that most of the teachers sometimes used and one third teachers do not used YouTube to self-preparation for teaching and learning mathematics. This table also shows that statement 4, 5 and 6 are significant that means which were good statement for this research. As above more than 50% teachers on always and frequently practices YouTube to understand mathematical concept but least number of teachers do not use YouTube. Furthermore, in statement 5, the results indicate that 39.1% teachers use YouTube for downloading documents but least on always and never. Moreover, statements 6 shows that 49.3% teachers never used projector to demonstrate YouTube video. But least teachers always and frequently used. Also statement 7 is non-significant with χ^2 -value 7.26 that means this statement do not preserve goodness. This conclude that most of the teachers did not refer their students to use YouTube. Likewise, statement 8 is significant, means it preserves the goodness of questionnaire. Table shows that more than half percent of teachers always use but minimum number of teachers never use YouTube to bring new pedagogy for teaching mathematics.

As analyzed in table 4.1, the χ^2 -value of statement 9, 10 ,11 ,12 & 13 are significant. This shows that chi square values are more than critical value. Thus, these statement preserves goodness of good questionnaire. The statement 9 results that

73.3% teachers always used Facebook/messenger but least number of teachers never used Facebook/messenger. Furthermore, the statement 10, indicates that's most of the teachers use Facebook/messenger for mathematics learning. Likewise, statements 11&12 results that almost teachers sometimes used Facebook/messenger to communicate and share mathematical solutions. Moreover, results of statement 13 shows that one third of teachers frequently refers their students to used Facebook/messenger but minimum number of teachers always refer their students to use Facebook/messenger.

From this above analysis, the researcher found that above 50% secondary mathematics teachers always and frequently practice YouTube and around one third of secondary school's mathematics teachers sometimes used Facebook/messenger in their teaching and learning mathematics.

Online Resources. Online resources is second dimension among four dimensions. Statement 14 to 18 are related to Gmail and statement 19 to 24 are related to Google. This table consist the response of secondary schools' mathematics teachers practices of online resources in teaching and learning mathematics. The result under this category is presented is table 4.2.

Table 4.2: Responses of secondary school's mathematics teachers on online resources

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
Gmail							
14. I use Gmail.	45.7	4.3	17.4	10.9	21.7	22.9	S
15. I use Gmail for mathematics learning.	8.7	2.2	37	15.2	37	24	S

16. I use Gmail to give homework/assignment.	0	0	15.2	15.2	69.6	75.96	S
17. I use Gmail to demonstrate mathematical solution in classroom by projector.	0	8.7	21.7	13	56.5	44	S
18. I refer to students to use Gmail to share mathematical document, submit assignment.	0	4.3	19.6	17.4	58.7	49.43	S
Google							
19. I use Google.	56.5	26.1	15.2	0	2.2	48.5	S
20. I use Google for mathematics learning.	21.7	37	32.6	4.3	4.3	21.61	S
21. I use Google when I confused in any mathematical problems.	41.3	28.3	13.0	10.9	6.5	19.21	S
22. I use Google to search abstract mathematical problems.	47.9	17.4	21.7	6.5	6.5	24.22	S
23. I use Google to demonstrate mathematical solutions in classroom by projector.	15.2	8.7	26.1	13.0	37	12.04	S
24. I refer to my students for visit google to encounter any mathematical problems.	23.9	21.7	15.2	23.9	15.2	1.82	NS

As analyzed in the table 4.2, the χ^2 -value of statement 14 is 22.91 which is significant. This means the chi square value is more than critical value. Thus, this

statement preserves goodness of good questionnaire. A total of around 50% teachers gave their response on always and frequently practices but less than one third teachers responded on never. This shows that most of the teachers agreed on statement 'I use Gmail' but minimum number of teachers never used Gmail. Likewise, table shows that Statement 15,16, 17 and 18 are significant, means preserves the goodness of questionnaire. The responses on statement 15 shows that above 50% teachers used Gmail for mathematics learning. But least number of teachers always used Gmail. Furthermore, the responses on statement 16 concluded that 76.9% teachers never used Gmail to give assignments but no one teachers always used Gmail to give assignments. Moreover, from above responses on statement 17 clear that above 50% teachers never used Gmail but no one teachers always used Gmail to demonstrate mathematical solutions by projector. likewise, the responses on statement 18 concluded that 56.5% teachers never refer their students to use Gmail. But no one teachers always refer their students to use Gmail to share mathematical document.

As analyzed in the table 4.2, the χ^2 -value of statement 19 is 48.56 which is significant this clears that it preserves goodness of questionnaire. From table responses of teachers on this statement shows that 56.5% teachers agreed on statement 'I use Google' but least number of teachers do not agree on this statement. Furthermore, table shows that statement 20, 21, 22, 23 are significant that mean these statements are good for this research. The responses of teachers on statements 20 shows that above half of total teachers always and frequently used Google for learning mathematics. But minimum teachers always used Google for learning mathematics. Likewise, the responses on statement 21 shows that above 50% teachers always and frequently used Google but least number of teachers never used Google when they confused in mathematical problem. From above table the responses on

statement 22 shows that above 50% teachers always and frequently used but less than one third teachers rarely and never used Google to search mathematical problems. Moreover, statement 23 concluded that one third of total teachers always and frequently used but most of the teachers never used Google to demonstrate mathematical solutions in classroom by projector. Same as, statement 24 is non-significant with χ^2 -value 1.82, this means this statement did not preserves the goodness of questionnaire. Table shows that 23.9% teachers always refer their students and almost teachers do not refer their students to visit Google to encounter any mathematical problem.

From this above analysis. The researcher found that almost secondary schools mathematics teachers never used Gmail, but least number of teachers sometimes used Gmail in their teaching and learning mathematics. On the other hand, most of the teachers frequently used Google but least number of teachers never used Google in their teaching and learning mathematics.

Mobile Application. Mobile application is third dimension among four dimensions. Statement 25 to 28 are related to mobile application this table consist the response of secondary schools' mathematics teachers practices of mobile application in teaching and learning mathematics. The result under this category is presented is table 4.3.

Table 4.3: Responses of secondary school's mathematics teachers on mobile applications

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
25. I use mobile applications.	39.1	15.2	17.4	0	28.3	19.8	S
26. I use mobile apps for mathematics	17.4	21.7	28.3	4.3	28.3	9	NS

learning.							
27 I use mobile apps to self-preparation for teaching and learning.	15.2	26.1	23.9	2.2	32.6	12.7	S
28 I refer to my students to use mobile apps for encounters mathematical problems.	10.9	19.6	17.4	13	39.1	11.61	S

As analyzed in the table 4.3, the χ^2 -value of statement 25 is 19.87 which is significant, which is greater than critical value therefore, it preserves the goodness of questionnaire. From above table shows that 39.1% teachers always use mobile application but one third of teachers never use mobile application. Also, the statement 26 is non-significant with χ^2 -value 9 which lies in critical region, so this is not good statement for this research study. In this statement around one third teachers responded on always and frequently, 28.3% responded on sometimes but more than one third teachers responded on never practice. This result says that above one third of teachers always use but one third of teachers never used mobile app for mathematics learning. Furthermore, statement 27 & 28 are significant with χ^2 -value 12.7 & 11.61 respectively. This means these were good questionnaire. On statement 27 according to above table most teachers always and frequently used mobile app but around one third of teachers never used mobile application to self-preparation for teaching and learning mathematics. Moreover, responses of teachers on statement 28 indicate that around one third of teachers always refer their students to use mobile application for encounter mathematical problems. Also shows that 39.1% teachers never refer their students to use mobile application for encounter mathematical problems.

From this above analysis, the researcher found that most of the secondary school's mathematics teachers never used mobile application in teaching and learning mathematics and around one third of teachers frequently used mobile application in teaching and learning mathematics. It is concluded that the secondary school's mathematics teachers have minimum practices in mobile application.

Mathematical Software. Mathematical software is fourth dimension among four dimensions. Statement 29 to 35 are related to GeoGebra and statement 36 to 41 are related to Midas class. This table consist the response of secondary schools' mathematics teachers practices of Mathematical software in teaching and learning mathematics. The result under this category is presented is table 4.4.

Table 4.4: Responses of secondary school's mathematics teachers on mathematical software's

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
GeoGebra							
29. I use GeoGebra.	0	2.2	17.4	6.5	73.9	87.79	S
30. I use GeoGebra to visualize Geometrical Theorems.	0	4.3	8.7	10.9	76.1	92.04	S
31. I use GeoGebra to self-preparation for teaching and learning mathematical theorems and problems.	0	2.2	8.7	10.9	78.3	99.43	S
32. I use GeoGebra to demonstrate mathematical concepts related to.	0	0	15.2	6.5	78.3	101.17	S
33. I refer to my students to use	0	2.2	15.2	4.3	78.3	100.7	S

GeoGebra for developing knowledge and creativity in mathematics.						3	
34. I use GeoGebra for mathematical works demonstrate by projector.	0	2.2	2.2	15.2	80.4	108.34	S
35.I use GeoGebra to give homework's/assignments.	0	2.2	4.3	10.9	82.6	114.21	S
Midas Class							
36. I use Midas Class.	6.5	4.3	15.2	13	60.9	49.87	S
37. I use Midas Class for mathematics teaching and learning.	0	10.9	19.6	10.9	58.7	47.47	S
38. I use Midas Class to self-preparation for new knowledge of mathematics.	4.3	6.5	19.6	10.9	58.7	46.17	S
39. I use Midas Class to self-preparation for teaching and learning mathematical problems.	4.3	4.3	15.2	17.4	58.7	46.39	S
40. I use Midas Class to demonstrate mathematical concepts related to content.	4.3	0	13	17.4	65.2	63.13	S
41. I refer to my students to use Midas Class for developing knowledge and creativity in mathematics.	4.3	2.2	10.9	23.9	58.7	49.65	S

As analyzed in the table 4.4 the χ^2 -value of statement 29 is 87.79 which is significant. This means the chi square value is more than critical value. Thus, this statement preserves goodness of good questionnaire. As above table the response of teachers on this statement shows that a total of 73.9% teachers never used GeoGebra, least number of teachers sometimes practices GeoGebra but no one teachers' practices GeoGebra always. Furthermore, table shows that Statement 30,31,32,33,34 and 35 are highly significant with χ^2 -value 92.04, 99.43, 101.17, 100.73, 108.34 and 114.2 respectively. This means these statements preserves goodness of questionnaire. From above table responses of teachers on statement 30 shows that 73% teachers responded on never practices and no one teachers responded on always practices. So, this conclude that most of the teachers never use GeoGebra to visualize geometrical theorems. Likewise, responses on statement 31, 32 & 33 shows that 78.3% teachers never use GeoGebra to self-preparation and to demonstrate mathematical concepts in classroom by projector. Same as, the results of statement 35 shows 82.6% teachers never used and no one teachers always used GeoGebra to give assignment.

According to above table, Statement 36 is significant with χ^2 -value 49.87. This means the chi square value do not lies on critical region. Thus, this is good questionnaire. The above table shows that 60.9% teachers responded on never practices and minimum teachers responded on always practices that means most of the teachers use Midas class. Furthermore, from table statement 37, 38, 39, 40 & 41 all are significant, means the chi square value were more than critical value. Hence, these are good statement for this research study. the responses of teachers on statement 37 shows that 58.7% teachers never used but least number of teachers sometimes and frequently used Midas class for their mathematics teaching and

learning. Likewise, the responses of teachers on statement 38 & 39 shows that 58.75% teachers never used and minimum number of teachers always used Midas class to get new knowledge and to self-preparation for teaching and learning mathematics. Same as, the responses on statement 40 shows that 65.2% teachers never used and just 4.3% teachers always used Midas class to demonstrate mathematical problems in classroom. Moreover, the responses of teacher on statement 41 concluded that 58.7% teacher never, one third of total teachers rarely and sometimes but least number of teachers refer their students to visit Midas class for developing knowledge and creativity in mathematics.

From this above analysis, the researcher found that 70% of the secondary school's mathematics teachers never used and no one teachers always used GeoGebra in their teaching and learning mathematics. Also shows that above 70% of the secondary school's mathematics teachers never used and minimum number of teachers always and frequently used Midas class in their teaching and learning mathematics. It is concluded that secondary school's mathematics teachers have minimum practices in mathematical software in teaching and learning mathematics.

Students' Practices of ICT Tools in Learning Mathematics

To achieve the first objectives of study, 146 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; social media, online resources, mobile applications and mathematical software. The analysis and interpretations of each category is presented separately in the succeeding sections.

Social Media. Social media is first dimension among four dimensions. Statement one to eight are related to YouTube and statement nine to 13 are related to

Facebook/messenger. This table consist the response of secondary schools' students' practices of social media in learning mathematics. The result under this category is presented is table 4.5.

Table 4.5:Responses of secondary school's students on social media

Statement	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
YouTube							
1. I use You Tube.	23.3	30.1	29.5	7.5	9.6	34.0	S
2. I use You Tube for learning mathematics.	1.4	13	44.5	18.5	22.6	73.45	S
3. I use You Tube to self-preparation for learning mathematics.	2.7	11.6	36.3	24	25.5	49.48	S
4. I use You Tube to understand abstract mathematical concept.	2.7	12.3	36.3	25.3	23.3	48.31	S
5. I use You Tube for downloading document related to.	6.8	19.2	20.5	25.3	28.1	19.54	S
6. My teacher demonstrate You Tube video in my classroom by projector.	1.4	1.4	15.8	32.2	49.3	125.57	S
7. We visit You Tube to prepare homework/assignment in groups.	4.6	8.9	22.6	24.7	39	54.41	S
8. I use You Tube to bring new idea for learning mathematics.	4.8	9.6	32.2	30.8	22.6	44.68	S

Facebook/messenger							
9. I use Facebook/messenger.	22.6	23.3	21.2	11	21.9	7.63	NS
10. I use Facebook/messenger for mathematics learning.	7	20.5	24	13.7	41.1	63.79	S
11. I use Facebook/messenger to share abstract mathematical problems and their solution.	2.1	16.4	28.8	18.5	34.2	45.02	S
12. I communicate in Facebook/messenger with my friends to solve abstract mathematical problems.	6.8	15.8	29.5	17.8	30.1	28.31	S
13. We communicate, share and encounter mathematical problems with teacher and friends.	7.5	10.3	21.2	15.8	45.2	66.05	S

As analyzed in the table 4.5, the χ^2 -value of statement one is 34.06 which is significant, that means the chi square value is more than critical value. Thus, this statement preserves goodness of questionnaire. As above table shows that in statement one, a total nearly one third percent of total students responded on always, more than one third students responded on sometimes and frequently practices but minimum students responded on never. This shows that no more students have practices on YouTube. furthermore, table shows that Statement 2, 3, 4. 5, 6, 7 & 8 all are significant, means these statements also preserves goodness of questionnaire. The responses of students on statement 2 shows that a total of only 1.4% students always

used, 44.5% students sometimes used and less than one third of total students never used YouTube for learning mathematics. Moreover, the responses of students on statement 3 shows that one third of total students never used, one third of total students sometimes used but least number of total students always used YouTube to self-preparation for learning mathematics. Same as, the responses on statement 4 shows that only 2.7% always used, nearly one third students never used and more than one third of total students never used YouTube to understand mathematical concepts. Likewise, the responses on statement 5 shows that minimum number of students always used, below one third of total students sometimes used but above 50% students never used YouTube for downloading mathematical video for mathematics learning. Also, on statement 6 around 50% students responded on never practices and least number of total students responded on always. This result concluded that most of their teachers never demonstrate YouTube video in classroom. Also, from above table, the responses of students on statement 8 shows that one third of total students never visit YouTube to prepare assignment. According to above table the responses on statement 8 shows that least number of students always used, more than one third of total students sometimes used and less than one third students never used YouTube to bring new idea for learning mathematics.

As analyzed in table 4.5, the χ^2 -value of statement 9 is 7.63 which is non-significant. That means chi square value lies in critical region. Thus, this statement does not preserve goodness of good questionnaire. The responses of students on this statement shows that most of the students never used Facebook/messenger but least number of students always used Facebook/messenger. Furthermore, from table statement 10, 11, 12, & 13 are significant, means these statements preserve goodness. The responses of students on statement 10 shows that above one third of total students

never used and less than one third of total students sometimes used Facebook/messenger for mathematics learning. Likewise, statements 11 & 12 results that almost students sometimes used Facebook/messenger to communicate and share mathematical solutions with their friends. Moreover, results of statement 13 shows that 45.2% students never used and minimum number of students always used Facebook/messenger to share and encounter mathematical problems with teachers and friends.

From this above analysis, the researcher found that more than one third of secondary schools' students sometimes practices YouTube and most of the secondary school's students never used Facebook/messenger in learning mathematics.

Online Resources. Online resources is second dimension among four dimensions. Statement 14 to 18 are related to Gmail and statement 19 to 24 are related to Google. This table consist the response of secondary schools' students' practices of online resources in learning mathematics. The result under this category is presented is table 4.6.

Table 4 6: Responses of secondary school's students on online resources

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
Gmail							
14. I use Gmail.	7.5	6.8	17.1	21.2	47.3	78.93	S
15. I use Gmail for mathematics learning.	2.1	2.7	13.7	18.8	63	183.38	S
16.I use Gmail to submit homework/assignment.	0	2.7	11	12	75.3	245.43	S

17.My teacher uses Gmail to demonstrate mathematical solution in classroom by projector for well teaching and learning.	2.7	4.1	11.6	9.6	71.9	249.95	S
18. My teacher refers us to use Gmail to share mathematical document, submit assignment.	7.5	8.2	12.3	13.7	58.5	135.30	S
Google							
19. I use Google.	30.8	19.2	28.8	11.6	9.6	26.5	S
20. I use Google for mathematics learning.	12.3	21.9	28.1	21.9	15.8	10.91	S
21. I use Google when I confused in any mathematical problems.	11.6	15.8	33.6	24	15.1	22.76	S
22. I use Google to search abstract mathematical problems.	6.2	16.4	34.2	19.2	24	30.91	S
23. My teacher uses Google to demonstrate mathematical solutions in classroom by projector for effective learning.	2.7	3.4	22.6	16.4	54.8	131.60	S
24. My teacher refers us for visit google to encounter any mathematical problems.	13	14.4	26	17.1	29.5	15.64	S

As analyzed in the table 4.6 the χ^2 -value of statement 14 is 78.93 which is significant. This means the chi square value is more than critical value. Thus, this statement preserves goodness of good questionnaire. In this statement as above the responses of students shows that most of the student did not use Gmail. Furthermore, the statement 15, 16, 17 & 18 are highly significant with the χ^2 -value 183.38, 245.43, 249.95 & 135.30 respectively. This means the chi square value are more than critical value. Thus, these statements preserve goodness. According to above table the responses of students on statement 15 shows that more than 60% students never used Gmail but least number of students always used Gmail for learning mathematics. Likewise, the responses of students on statements 16 shows that no one students used Gmail to submit assignment and above 75% students used Gmail to submit assignment. Same as, from statements 17 responses it is concluded that almost teachers did not use Gmail to demonstrate mathematical solutions in classroom. Moreover, statement 18 shows that above 58.2% students responded on never practices Gmail and minimum student responded on always practice Gmail. This shows that most of the teachers did not refer their students to share mathematical document and submit assignment on Gmail.

As analyzed in the table 4.6, the χ^2 -value of statement 19 is 26.55 which is significant this clears that it preserves goodness of questionnaire. From table responses of students around one third of total students has always practices on Google. Furthermore, from table statements 20, 21, 22, 23, and 24 are also significant that mean chi square values are more than critical value so, these statements are good for this research study. The responses of students on statement 20 shows that only 12.3% students always used and more than one third students use Google for learning mathematics. Likewise, the responses on statement 21 concluded that above one third

of total students sometimes used Google but least number of students never used Google when they confused in mathematical problem. From above table the responses on statement 22 shows that 34.4% students sometimes used but less than one third students always and frequently used Google to search mathematical problems. Moreover, on statement 23 minimum number of students responded on always and frequently used but most of the students responded on never used Google this means their teachers did not used Google demonstrate mathematical solutions in classroom by projector. Same as, on statement 24 more than one third of total students responded on always practices, more than one third of total students responded on never practices and one third of total students responded on sometimes practices. This shows that minimum number of teachers refer students for visit Google to encounter any mathematical problem.

From this above analysis, the researcher found that almost secondary schools' students never used Gmail for learning mathematics. On the other hand, most of the students sometimes used Google in learning mathematics.

Mobile Application. Mobile application is third dimension among four dimensions. Statement 25 to 28 are related to mobile application. This table consist the response of secondary schools' students' practices of mobile application learning mathematics. The result under this category is presented is table 4.7.

Table 4.7: Responses of secondary school's students on Mobile Application

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
25. I use mobile applications.	39	17.8	20.5	12.3	10.3	38.4	S
26. I use mobile apps for mathematics learning.	8.9	16.4	39	19.9	15.8	37.69	S

27. I use mobile apps to self-preparation for mathematics learning.	5.5	19.2	22.6	24.7	28.1	22.28	S
28. My teacher advises us to use mobile apps for encounters mathematical problems.	6.8	14.4	19.2	19.9	39.7	43.38	S

As analyzed in the table 4.7, the χ^2 -value of statement 25 is 38.04 which is significant. Which is greater than critical value. Hence, it preserves the goodness of questionnaire. From above table shows that 39% students always use mobile application and only 10% students never use mobile application. Also, the statement 26, 27 & 28 are significant, means the value of chi square are more than critical value therefore, these are good statement for this research study. Furthermore, the response of students on statement 26 shows that minimum number of students always used mobile application for learning mathematics. Likewise, the responses of students on statement 27 shows that most of the students never used but least number students always used mobile application to self-preparation for mathematics learning. Moreover, on statement 28 39.7% students responded on never practices, 19.2% students responded on sometimes and rarely practices and only 6.8% students responded on always practices mobile application. It is concluded that most of the teachers did not advice students to use mobile application but least number of teacher's advices their students to use mobile application for learning mathematics.

From this above analysis, the researcher found that most of the secondary school's students never used mobile application in learning mathematics. It is

concluded that the secondary school' students has minimum practices in mobile applications.

Mathematical Software. Mathematical software is fourth dimension among four dimensions. Statement 29 to 35 are related to GeoGebra and statement 36 to 41 are related to Midas class. This table consist the response of secondary schools' students' practices of Mathematical software in learning mathematics. The result under this category is presented is table 4.8.

Table 4.8: Responses of secondary school's students on mathematical software's

Statements	**A %**	**F %**	**S %**	**R %**	**N %**	χ^2	**D**
GeoGebra							
29. I use GeoGebra.	1.4	0.7	3.4	2.7	91.8	470.5	S
30. I use GeoGebra to see visual representation of Geometrical Theorems.	0.7	0.7	0.7	4.8	93.2	489.20	S
31. I use GeoGebra to self-preparation for learning mathematical theorems and problems.	0	0.7	0.7	4.8	93.8	498.52	S
32. I use GeoGebra to demonstrate mathematical concepts related to mathematics with my friends.	0	0.7	3.4	0.7	95.2	516.60	S
33. My teacher refers us to use GeoGebra for developing knowledge and creativity in	0.7	0.7	4.1	3.4	91.1	461.94	S

mathematics.							
34. I use GeoGebra for mathematical works.	2.1	0.7	2.1	2.1	93.2	488.38	S
35. I use GeoGebra to submit homework's/assignments	0	2.1	2.1	0.7	95.2	516.32	S
Midas class							
36. I use Midas class.	1.4	6.8	11.6	6.8	73.3	262.9	S
37. I use Midas Class for mathematics learning.	0.7	6.2	14.4	11	67.8	216.32	S
38. I use Midas class to self-preparation for mathematical concepts.	1.4	7.5	12.3	8.9	69.9	231.46	S
39. My teacher uses Midas Class to show any mathematical concepts by projector for beater teaching and learning.	0	4.1	15.1	8.9	71.9	255.16	S
40. My teacher refers us to use Midas for mathematics learning.	1.4	3.4	17.8	8.2	69.2	232.42	S
41. My teacher refers us to use Midas for developing creativity and mathematics learning.	0.7	5.5	16.4	11.6	65.8	201.46	S

As analyzed in the table 4.8 the χ^2 -value of statement 29 is 470.50 which is highly significant. This means the chi square value is more than critical value. Thus, this statement is good for this research. As above table the response of teachers on this

statement shows that a total of 91.8% students never used GeoGebra, but least number of students always used GeoGebra. Furthermore, table shows that Statement 30,31,32,33,34 and 35 are highly significant. This means these statements preserves goodness of questionnaire. From above Table responses of students on statement 30 & 31 shows that 93.2% students never practice and just 0.7% students used always GeoGebra to see visual representation of geometrical theorems and self-preparation for learning mathematical theorems. Likewise, responses of students on statement 32 shows that 95.2% never use but no one students used GeoGebra with friends to demonstrate mathematical concepts in classroom. Same as, from table on statement 33 above 90% students responded on never practices this means their teachers did not refer students to use GeoGebra for developing knowledge and creativity in mathematics. Moreover, the responses on statement 35 shows 95.2% students never used and no one students always used GeoGebra to submit assignment.

According to above table, Statement 36 is highly significant with χ^2 -value 262.97. This means the chi square value do not lies on critical region. Thus, this is good questionnaire. The above table shows that 73.4% students never used and only 1.4% students always used Midas class. Furthermore, from above table statement 37, 38, 39, 40 & 41 all are also significant, means the chi square value were more than critical value. Hence these are good statement for this research study. The responses of students on statement 37 shows that 0.7% students always used but least number of students frequently used Midas class but more than 60% students never used Midas class for mathematics learning. Likewise, the responses of students on statement 38 shows that 69.9% students never used and minimum number of students always used Midas class to self-preparation for learning mathematics. Same as, the responses on statement 39 shows that most of the teachers never used Midas class in classroom for

better teaching and learning. Above table also shows that the responses of students on statement 40 concluded that most of the teachers never refer their students to use Midas class for learning mathematics. Moreover, om statement 41 a total of 65.8% students responded on never practices, lower than one third student responded on sometimes practices and just 0.7% students responded on always practices. This shows that most of the teachers did not refer their students to visit Midas class for developing creativity and learning mathematics.

From this above analysis. the researcher found that above 90% of the secondary school's students never used GeoGebra in learning mathematics. Also shows that above 60% of the secondary school's students never used Midas class in learning mathematics. It is concluded that secondary school' students has minimum practices in mathematical software in learning mathematics.

Comparison of Community and Institutional School's Teachers Practices of ICT Tools in Teaching and Learning Mathematics

The researcher had found the practices of ICT tools in teaching and learning mathematics on the basis of obtained data from secondary school's mathematics teaches and students which were analyzed and interpreted above. To identify the second objective the obtained data were divided into category, as community and institutional schools.

The second objective of this study was to compare the community and institutional schools' teachers and students' practices of ICT tools in teaching and learning mathematics. To compare the community and institutional schools' teachers practices of ICT tools, mean and SD were computed, tabulated and analyzed in table 4.9.

Table 4.9: Mean, standard deviation and t- Value of community and institutional schools' teachers

Comparison	N	Mean	SD	Calculated value	t-value	Decision
Community teachers	30	2.53	0.77	-1.45	1.96	Significant
Institution teachers	16	2.82	0.59			

N = sample size = 46

d. f. = degree of freedom ($N_1 + N_2 - 2$) = 30 + 16 -2 = 44

The table 4.9 shows that there were 30 community secondary schools mathematics teachers and 16 institutional secondary schools mathematics teachers. The mean score of community teachers is 2.53 and institutional teachers is 2.82 and their SD of community and institutional school's teachers were 0.77 and 0.59 respectively with the degree of freedom 44. The calculated t-value with respect to difference of mean score -1.45 which lies between tabulated value (± 1.96) at 0.05 level of significance. Thus, there is no significance difference between community and institutional schools' mathematics teachers' practices of ICT tools. It is concluded that community and institutional school's mathematics teachers both has no difference practices of ICT tools in teaching and learning mathematics.

Comparison of Community and Institutional School's Students Practices of ICT Tools in Learning Mathematics

To identify the second objective the obtained data were divided into category, as community and institutional secondary schools' students. To compare the community and institutional schools' students' practices of ICT tools in learning mathematics, mean and SD were computed, tabulated and analyzed in table 4.10.

Table 4.10: Mean, standard deviation and t- Value of community and institutional schools' students

Comparison	N	Mean	SD	Calculated value	t-value	Decision
Community students	90	2.16	0.50	2.01	1.96	Significant
Institution students	56	1.99	0.41			

N=sample size=146

d. f.=degree of freedom ($N_1 + N_2 - 2$) = 90 + 56 -2 = 144

The table 4.10 shows that there were 90 community secondary schools' students and 56 institutional secondary school's students. The mean score of community schools' students is 2.16 and institutional schools' students is 1.99 and their SD of community and institutional school's students were 0.50 and 0.41 respectively with the degree of freedom 144. The calculated t-value with respect to difference of mean score 2.01 which did not lie between tabulated value ($\pm$1.96) at 0.05 level of significance. Thus, there is significance difference between community and institutional schools' students' practices of ICT tools in learning mathematics. Researcher found that community schools students have better practices of ICT tools in learning mathematics than institutional school's students.

Finally, the researcher concluded that there is no better practices of ICT tools and technology in secondary school's mathematics teachers and students in teaching and learning mathematics. May the non-availability of ICT tools and opportunity play the vital role because many researches show that teachers and students have positive perceptions on technology tools. Although, ICT supports constructivist pedagogy where students use technology to explore, search and understanding of mathematical

concepts where it promotes higher order thinking and better problem-solving strategies. Constructivist class students are motivated to share their ideas, experience and expand their knowledge through ICT tools. The use of ICT tools in classroom is based upon the assumptions of constructivism where teachers should play role of instructor and students are actively participating. The results of this research study may find opposing to the assumptions of constructivist approach. Therefore, the result of this finding was interlinked with constructivism theory.

Chapter V

Summary, Findings, Conclusion and Recommendation

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

Summary of this Study

Mathematics is one of the core subjects in school level curriculum in our formal education system. Most of the Students have negative impression on mathematics, as abstract subjects. In this situation the development of ICT tools and technology highly influencing people and education system. The use of ICT tools in education can enhance meaningful learning better than traditional instructions. Therefore, to encounter negative impression towards mathematics and for effective mathematics learning, Tribhuvan university designed and implementing ICT course in mathematics education since 2070. So, researcher had tried to study with some purpose to identify the practices of ICT tools in teaching and learning mathematics.

The main proposes of the study were to find out the community and institutional mathematics teachers and student's practices of ICT tools in teaching and learning mathematics. The researchers adopted the survey research design for this study. The questionnaire was used as tools of the study, which was developed on the basis of conceptual framework. The questionnaire form included 41 statement on the basis of four dimension: social media, online resources, mobile application and mathematical software. The researcher adopted constructivism approach. The use of ICT in classroom is based upon the assumptions of constructivism where teachers should play role of instructor and students are actively participating. Furthermore, constructivist class students are motivated to share their ideas, experience and expand

their knowledge through ICT tools. The 46 secondary school's mathematics teachers and 146 secondary schools' students were taken form 15 community and 8 institutional secondary sample school of Dhankuta district. The study was limited on Dhankuta district of Nepal. The five-point rating scale made of always, frequently, sometimes, rarely and never was adopted to collect data and respondent were asked to indicate their options with the tick mark. The collected data were analyzed by using following statistical tools: chi square at 0.05 level of significance was used to find the responses of teachers and students is significance or non-significance. The percentage of responses was used to find the practices of ICT tools in teaching and learning mathematics. Also, t-test at 0.05 level of significance was used to compare community and institutional secondary 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;

- Above 50% secondary school's mathematics teachers always practice YouTube and around one third of secondary school's mathematics teachers sometimes used Facebook/messenger in their teaching and learning mathematics.
- Almost secondary school's mathematics teachers never used Gmail, but least number of teachers sometimes used Gmail in their teaching and learning mathematics. But most of the teachers frequently used Google in their teaching and learning mathematics.
- Most of the secondary school's mathematics teachers has minimum practices in mobile application.

- Above 70% secondary school's mathematics teachers never used GeoGebra and Midas class in their teaching and learning mathematics. It is concluded that secondary school's mathematics teachers have minimum practices in mathematical software in teaching and learning mathematics.
- Above one third of secondary schools' students sometimes practices YouTube and most of the students never used Facebook/messenger in learning mathematics.
- Almost secondary schools' students never used Gmail and most of the students sometimes used Google in learning mathematics.
- Secondary school' students has minimum practices in mobile application.
- Above 90% of the secondary school's students never used GeoGebra in learning mathematics and above 60% of the secondary school's students never used Midas class in learning mathematics. It is concluded that secondary school' students has minimum practices of mathematical software in learning mathematics.
- The calculated t-value with respect to difference of mean score -1.45 which lies between tabulated value ($\pm$1.96). Thus, community and institutional school's mathematics teachers both has no difference practices of ICT tools in teaching and learning mathematics.
- The calculated t-value with respect to difference of mean score 2.01 which did not lie between tabulated value ($\pm$1.96). Thus, there is significance difference between community and institutional schools' students' practices of ICT tools. Therefore, community school's students have better practices of ICT tools in learning mathematics than institutional school's students.

Conclusion

On the basis of research findings, the researcher concluded that the community and institutional secondary school's mathematics teachers have no significant difference on practices of ICT tools in teaching and learning mathematics. Furthermore, there is minimum number of teacher's always practice ICT tools, almost teachers frequently/sometimes/rarely practice tools in their teaching learning activities. Similarly, researcher concluded that the community and institutional secondary school's students have significant difference on practices of ICT tools in learning mathematics. Moreover, there is minimum number of students on always and never practices ICT tools but almost students on frequently/sometimes/rarely practices ICT tools. It is concluded that community school students have better practices of ICT tools than institutional school students in learning mathematics.

The researcher come to the conclusion that government of Nepal, MOE, CDC other concerned bodies should give information about implementation and how to practices ICT tools in school level. Research shows that most of the mathematics teachers are not literate by ICT tools and technology. Thus, the government of Nepal and Private and Boarding Schools' Organization Nepal (PABSON), should develop ICT related school mathematics course and provide proper training of ICT use in mathematics teaching and learning. Should provide ICT access in all schools as well as should develop ICT mathematics lab in all schools.

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 ICT related mathematics course and provide training for all community schools mathematics teachers.
- Institutional schools should develop ICT related mathematics course and provide training for all mathematics teachers.
- Community and institutional school's administration should develop ICT mathematics lab in schools.
- Community and institutional schools' students' parents should provide opportunity to use ICT tools for their children's.
- 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 practices of urban teachers/ students and rural teachers/students towards ICT tools.

Reference

Bature, B. (2016). The Role of Information and Communication Technology as a Tool for Effective Teaching and Learning of Mathematics. *Applied & Computational Mathematics*, 1-3. doi:10.4172/2168-9679.1000333

Chan, D. (2002). The role of ICT in a constructivist approach to the teaching of thinking skills. e-library CLD, SAFTIMI.

Danai, Y. (2017). *Effectiveness of information communication and technology (ICT) in teaching Geometry.* Unpublished Master's Thesis, Department of Mathematics Education T.U. Kirtipur, Kathmandu.

Daniels, J.S. (2002). *"*Foreword" in Information and Communication Technology in Education–A Curriculum for Schools and Programme for Teacher Development. Paris: UNESCO.

Gagnon et.al. (2008). *Teachers and students' perceptions on the use of ICT in mathematics teaching*. Retrieved form: https://www.academia.edu/16804434/TEACHERS_AND_STUDENTS_PERCEPTIONS_ON_THE_USE_OF_ICT_IN_MATHEMATICS_TEACHING

German, P. & Sasse, C.M. (1997). variation in concerns and attitude of science teacher in and educational technology development programme. *Journal of Computer in Mathematics and Science Teachinga.*

Ibrahim, N. (2016, November 15th). The influence of ICT tools in teaching and learning activities. *The 2nd International Multidisciplinary Conference* 2016, (pp. 496-502). Retrieved from https://jurnal.umj.ac.id/index.php/IMC/article/viewFile/1235/1111

Jhurreev, V. (2005)."Technology Integration in Education in Developing Countries: Guidelines to Policy Makers". *International Education Journal [Electronic]*, 6(4):467-483. Retrived from: http://ehlt.flinders.edu.au/education/iej/articles/v6n4/jhurree/paper.pdf.

Keong, C. C., Horani, S., & Daniel, J. (2005). A study on the use of ICT in mathematics teaching. *Malaysian Online Journal of Instructional Technology (MOJIT)*, 2(3), 43-51

Luitel, B.C. (2003). *Narrative explorations of Nepali mathematics curriculum landscapes: An Epic Journey*. MS Dissertation: Curtin University of Technology.

Muijs, D. (2004). *Doing Quantitative Research in Education with SPSS*. London, Thousand Oaks, New Delhi: Sage Publications.

Saud, D.B. (2018). *Attitude of students and teachers of using audio-video aids in learning on secondary level at Surkhet district*. Unpublished Mster's Thesis, Department of Mathematics Education T.U. Kirtipur, Kathmandu.

Sah, S.K. (2017). *Teachers attitude of media in teaching mathematics*. Unpublished Master's Thesis, Department of Mathematics Education T.U. Kirtipur, Kathmandu.

Shrestha, R. (2015). *Status of ICT use in teaching/learning mathematics*. T.U Kirtipur, Kathmandu: Unpublished Master's thesis Deparment of mathematics education.

Timilsena, T. R. (2017). *Attitude of teachers of ICT in teaching mathematics*. Unpublished Mster's Thesis, Department of Mathematics Education T.U. Kirtipur, Kathmandu.

Zovko, K. T. (2016), July 1st). The Use of ICT in Teaching Mathematics - A Comparative Analys was of the Success of 7th Grade Primary School Students. *Croatian Journal of Education*, 18, 215-221. doi: 10.15516/cje. v18i0.2177

Appendix A

Date: 2076/…. /....

Practice of ICT tools in teaching and learning and learning mathematics

Respected mathematics Teacher,

I am from the Central Department of Mathematics Education, TU, Kirtipur to conduct a research on "Practice of ICT tools in teaching and learning mathematic". Which is for the practical 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 fill the questionnaire as follows:

Please read carefully and respond how as you practice.

You have requested not to leave blank for any questions.

Researcher

Bhanu Bhakta Adhikari

bhanuadhikari22@gmail.com

Personal Details

Name: ……..…….

School Name: …….

Sex: …...…… Email: ……

Mobile Number: ……. Qualification: …….....

Please give tick mark (√) which you feel the best option where, A= Always (at least one time in a day), F= frequently(at least two or three times in a week), S= Sometimes(at least one times in a week), R= Rarely(at least two times in a month) and N= Never(at least one time in six month)

S.N.	Statements	A	F	S	R	N
Practices in social media						
You Tube						
1	I use You Tube.					
2	I use You Tube for learning mathematics.					
3	I use You Tube to self-preparation for teaching and learning mathematics.					
4	I use You Tube to understand abstract mathematical concept.					
5	I use You Tube for downloading document related to content.					
6	I demonstrate You Tube video in my classroom by projector.					
7	I refer to my student to watch You Tube for mathematics learning.					
8	I use You Tube to bring new idea and pedagogy for					

	teaching and learning mathematics.					
Facebook/messenger						
9	I use Facebook/messenger.					
10	I use Facebook/messenger for mathematics learning.					
11	I use Facebook/messenger to share abstract mathematical problems and their solution.					
12	I communicate in Facebook/messenger with my friends to solve abstract mathematical problems.					
13	I refer to my student to communicate, share and encounter mathematical problems with teacher and friends.					
Practices in online resources						
Gmail						
14	I use Gmail.					
15	I use Gmail for mathematics learning.					
16	I use Gmail to give homework/assignment.					
17	I use Gmail to demonstrate mathematical solution in classroom by projector.					
18	I refer my students to use Gmail to share mathematical document, submit assignment.					
Google						
19	I use Google.					
20	I use Google for mathematics learning.					
21	I use Google when I confused in any mathematical problems.					
22	I use Google to search abstract mathematical problems.					

23	I use Google to demonstrate mathematical solutions in classroom by projector.					
24	I refer to my students for visit google to encounter any mathematical problems.					
Practices in mobile applications (Microsoft mathematics, malMath, math's solver, High school math All Maths formula etc.)						
25	I use mobile apps.					
26	I use mobile apps for mathematics learning.					
27	I use mobile apps to self-preparation of for teaching and mathematical learning.					
28	I refer to my students to use mobile apps for encounters mathematical problems.					
Practices in mathematical software						
GeoGebra						
29	I use GeoGebra.					
30	I use GeoGebra to visualize Geometrical Theorems.					
31	I use GeoGebra to self-preparation for teaching and learning mathematical theorems and problems.					
32	I use GeoGebra to demonstrate mathematical concepts related to content.					
33	I refer to my students to use GeoGebra for developing knowledge and creativity in mathematics.					
34	I use GeoGebra for mathematical works demonstrate by projector.					

35	I use GeoGebra to give homework's/assignments.					
Midas Class						
36	I use Midas Class.					
37	I use Midas Class for mathematics teaching and learning.					
38	I use Midas Class to get new knowledge of mathematics.					
39	I use Midas Class to self-preparation for teaching and learning mathematical problems.					
40	I use Midas Class to demonstrate mathematical concepts related to content.					
41	I refer to my students to use Midas Class for developing knowledge and creativity in mathematics.					

Appendix B

Date: 2076/…. /....

Practice of ICT tools in teaching and learning and learning mathematics

Dear student,

I am from the Central Department of Mathematics Education, TU, Kirtipur to conduct a research on "Practice of ICT tools in teaching and learning mathematic". Which is for the practical 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 fill the questionnaire as follows:

Please read carefully and respond how as you practice.

You have requested not to leave blank for any questions.

Researcher

Bhanu Bhakta Adhikari

bhanuadhikari22@gmail.com

Personal Details

Name: …….…….

School Name: …….

Sex: …..…… Email: …….

Mobile Number: ……. Qualification: ……....

Please give tick mark (√) which you feel the best option where, A= Always (at least one time in a day), F= frequently(at least two or three times in a week), S= Sometimes(at least one times in a week), R= Rarely(at least two times in a month) and N= Never(at least one time in six month)

S.N.	Statements	A	F	S	R	N
Practices in social media						
You Tube						
1	I use You Tube.					
2	I use You Tube for learning mathematics.					
3	I use You Tube to self-preparation for learning mathematics.					
4	I use You Tube to understand abstract mathematical concept.					
5	I use YouTube for downloading document related to content.					
6	My teacher demonstrate You Tube video in my classroom by projector.					
7	We visit You Tube to prepare homework/assignment in groups.					
8	I use You Tube to bring new idea for learning mathematics.					

Facebook/messenger						
9	I use Facebook/messenger.					
10	I use Facebook/messenger for mathematics learning.					
11	I use Facebook/messenger to share abstract mathematical problems and their solutions.					
12	I communicate in Facebook/messenger with my friends to solve abstract mathematical problems.					
13	We communicate, share and encounter mathematical problems with teacher and friends.					
Practices in online resources						
Gmail						
14	I use Gmail.					
15	I use Gmail for mathematics learning.					
16	I use Gmail to submit homework/assignment.					
17	My teacher uses Gmail to demonstrate mathematical solution in classroom by projector for well teaching and learning.					
18	My teacher refers us to use Gmail to share mathematical document, submit assignment.					
Google						
19	I use Google.					
20	I use Google for mathematics learning.					
21	I use Google when I confused in any mathematical problems.					
22	I use Google to search abstract mathematical problems.					
23	My teacher use Google to demonstrate mathematical solutions					

	in classroom by projector for effective learning.					
24	My teacher refers us for visit google to encounter any mathematical problems.					
Practices in mobile applications (Microsoft mathematics, malMath, math's solver, High school math All Maths formula etc.)						
25	I use mobile apps.					
26	I use mobile apps for mathematics learning.					
27	I use mobile apps to self-preparation for mathematics learning.					
28	My teacher advises us to use mobile apps for encounters mathematical problems.					
Practices in mathematical software						
GeoGebra						
29	I use GeoGebra.					
30	I use GeoGebra to see visual representation of Geometrical Theorems.					
31	I use GeoGebra to self-preparation for learning mathematical theorems and problems.					
32	I use GeoGebra to demonstrate mathematical concepts related to mathematic with my friends.					
33	My teacher refers us to use GeoGebra for developing knowledge and creativity in mathematics.					
34	I use GeoGebra for mathematical works					
35	I use GeoGebra to submit homework's/assignments.					

Midas Class						
36	I use Midas class.					
37	I use Midas Class for mathematics learning.					
38	I use Midas class to self-preparation for mathematical concepts.					
39	My teacher use Midas Class to show any mathematical concepts by projector for beater teaching and learning.					
40	My teacher refers us to use Midas for mathematics learning.					
41	My teacher refers us to use Midas for developing creativity and mathematics learning.					

Appendix C

Responses of teachers

Statement	A %	F %	S %	R %	N %	χ^2	D
1. I use YouTube.	37	28.3	30.3	0	4.3	25.5	S
2. I use YouTube for learning mathematics.	17.4	37	34.8	2.2	8.7	22.0	S
3. I use YouTube to self-preparation for teaching and learning mathematics.	15.2	30.4	28.3	17.4	8.7	7.69	N
4. I use YouTube to understand mathematical concept.	21.7	30.4	30.4	8.7	8.7	10.95	S
5. I use YouTube for downloading document related to content.	8.7	32.6	39.1	8.7	10.9	19.87	S
6. I demonstrate YouTube video in my classroom by projector.	0	15.2	13	26.1	45.7	26.82	S
7. I refer to my student to watch YouTube for mathematics learning.	21.7	23.9	17.4	6.5	30.4	7.26	N
8. I use YouTube to bring new idea and pedagogy for teaching and learning mathematics.	26.1	34.8	23.9	2.2	13	14.65	S
9. I use Facebook/messenger.	73.9	13	10.2	0	2.2	86.39	S
10. I use Facebook/messenger for	17.4	26.1	39.1	6.5	10.9	15.52	S

	mathematics learning.						
11.	I use Facebook/messenger to share mathematical problems and their solution.	4.3	23.9	47.8	10.9	13	26.82	S
12.	I communicate in Facebook/messenger with my friends to solve mathematical problems.	10.9	19.6	47.8	13.0	8.7	23.78	S
13.	I refer to my student to communicate, share and encounter mathematical problems with teacher and friends.	8.7	37	21.7	13	19.6	10.73	S
25.	I use Gmail.	45.7	4.3	17.4	10.9	21.7	22.9	S
26.	I use Gmail for mathematics learning.	8.7	2.2	37	15.2	37	24	S
27.	I use Gmail to give homework/assignment.	0	0	15.2	15.2	69.6	75.96	S
28.	I use Gmail to demonstrate mathematical solution in classroom by projector.	0	8.7	21.7	13	56.5	44	S
29.	I refer to students to use Gmail to share mathematical document, submit assignment.	0	4.3	19.6	17.4	58.7	49.43	S
30.	I use Google.	56.5	26.1	15.2	0	2.2	48.5	S

31. I use Google for mathematics learning.	21.7	37	32.6	4.3	4.3	21.61	S
32. I use Google when I confused in any mathematical problems.	41.3	28.3	13.0	10.9	6.5	19.21	S
33. I use Google to search abstract mathematical problems.	47.9	17.4	21.7	6.5	6.5	24.22	S
34. I use Google to demonstrate mathematical solutions in classroom by projector.	15.2	8.7	26.1	13.0	37	12.04	S
35. I refer to my students for visit google to encounter any mathematical problems.	23.9	21.7	15.2	23.9	15.2	1.82	N
25. I use mobile applications.	39.1	15.2	17.4	0	28.3	19.8	S
26. I use mobile apps for mathematics learning.	17.4	21.7	28.3	4.3	28.3	9	N
27 I use mobile apps to self-preparation for teaching and learning.	15.2	26.1	23.9	2.2	32.6	12.7	S
28 I refer to my students to use mobile apps for encounters mathematical problems.	10.9	19.6	17.4	13	39.1	11.61	S
29. I use GeoGebra.	0	2.2	17.4	6.5	73.9	87.79	S
30. I use GeoGebra to visualize Geometrical Theorems.	0	4.3	8.7	10.9	76.1	92.04	S

31. I use GeoGebra to self-preparation for teaching and learning mathematical theorems and problems.	0	2.2	8.7	10.9	78.3	99.43	S
32. I use GeoGebra to demonstrate mathematical concepts related to.	0	0	15.2	6.5	78.3	101.17	S
33. I refer to my students to use GeoGebra for developing knowledge and creativity in mathematics.	0	2.2	15.2	4.3	78.3	100.73	S
34. I use GeoGebra for mathematical works demonstrate by projector.	0	2.2	2.2	15.2	80.4	108.34	S
35.I use GeoGebra to give homework's/assignments.	0	2.2	4.3	10.9	82.6	114.21	S
36. I use Midas Class.	6.5	4.3	15.2	13	60.9	49.87	S
37. I use Midas Class for mathematics teaching and learning.	0	10.9	19.6	10.9	58.7	47.47	S
38. I use Midas Class to self-preparation for new knowledge of mathematics.	4.3	6.5	19.6	10.9	58.7	46.17	S
39. I use Midas Class to self-preparation for teaching and learning mathematical	4.3	4.3	15.2	17.4	58.7	46.39	S

problems.							
40. I use Midas Class to demonstrate mathematical concepts related to content.	4.3	0	13	17.4	65.2	63.13	S
41. I refer to my students to use Midas Class for developing knowledge and creativity in mathematics.	4.3	2.2	10.9	23.9	58.7	49.65	S

Appendix D

Responses of students

Statement	A %	F %	S %	R %	N %	χ^2	D
1. I use You Tube.	23.3	30.1	29.5	7.5	9.6	34.0	S
2. I use You Tube for learning mathematics.	1.4	13	44.5	18.5	22.6	73.45	S
3. I use You Tube to self-preparation for learning mathematics.	2.7	11.6	36.3	24	25.5	49.48	S
4. I use You Tube to understand abstract mathematical concept.	2.7	12.3	36.3	25.3	23.3	48.31	S
5. I use You Tube for downloading document related to.	6.8	19.2	20.5	25.3	28.1	19.54	S
6. My teacher demonstrate You Tube video in my classroom by projector.	1.4	1.4	15.8	32.2	49.3	125.5	S
7. We visit You Tube to prepare homework/assignment in groups.	4.6	8.9	22.6	24.7	39	54.41	S
8. I use You Tube to bring new idea for learning mathematics.	4.8	9.6	32.2	30.8	22.6	44.68	S
9. I use Facebook/messenger.	22.6	23.3	21.2	11	21.9	7.63	NS
10. I use Facebook/messenger for mathematics learning.	7	20.5	24	13.7	41.1	63.79	S
11. I use Facebook/messenger to	2.1	16.4	28.8	18.5	34.2	45.02	S

share abstract mathematical problems and their solution.							
12. I communicate in Facebook/messenger with my friends to solve abstract mathematical problems.	6.8	15.8	29.5	17.8	30.1	28.31	S
13. We communicate, share and encounter mathematical problems with teacher and friends.	7.5	10.3	21.2	15.8	45.2	66.05	S
14. I use Gmail.	7.5	6.8	17.1	21.2	47.3	78.93	S
15. I use Gmail for mathematics learning.	2.1	2.7	13.7	18.8	63	183.38	S
16.I use Gmail to submit homework/assignment.	0	2.7	11	12	75.3	245.43	S
17.My teacher uses Gmail to demonstrate mathematical solution in classroom by projector for well teaching and learning.	2.7	4.1	11.6	9.6	71.9	249.9	S
18. My teacher refers us to use Gmail to share mathematical document, submit assignment.	7.5	8.2	12.3	13.7	58.5	135.3	S
19. I use Google.	30.8	19.2	28.8	11.6	9.6	26.5	S
20. I use Google for mathematics learning.	12.3	21.9	28.1	21.9	15.8	10.91	S

21. I use Google when I confused in any mathematical problems.	11.6	15.8	33.6	24	15.1	22.76	S
22. I use Google to search abstract mathematical problems.	6.2	16.4	34.2	19.2	24	30.91	S
23. My teacher uses Google to demonstrate mathematical solutions in classroom by projector for effective learning.	2.7	3.4	22.6	16.4	54.8	131.6	S
24. My teacher refers us for visit google to encounter any mathematical problems.	13	14.4	26	17.1	29.5	15.64	S
25. I use mobile applications.	39	17.8	20.5	12.3	10.3	38.4	S
26. I use mobile apps for mathematics learning.	8.9	16.4	39	19.9	15.8	37.69	S
27. I use mobile apps to self-preparation for mathematics learning.	5.5	19.2	22.6	24.7	28.1	22.28	S
28. My teacher advises us to use mobile apps for encounters mathematical problems.	6.8	14.4	19.2	19.9	39.7	43.38	S
29. I use GeoGebra.	1.4	0.7	3.4	2.7	91.8	470.5	S
30. I use GeoGebra to see visual representation of Geometrical Theorems.	0.7	0.7	0.7	4.8	93.2	489.2	S
31. I use GeoGebra to self-preparation	0	0.7	0.7	4.8	93.8	498.5	S

for learning mathematical theorems and problems.							
32. I use GeoGebra to demonstrate mathematical concepts related to mathematics with my friends.	0	0.7	3.4	0.7	95.2	516.6	S
33. My teacher refers us to use GeoGebra for developing knowledge and creativity in mathematics.	0.7	0.7	4.1	3.4	91.1	461.9	S
34. I use GeoGebra for mathematical works.	2.1	0.7	2.1	2.1	93.2	488.3	S
35. I use GeoGebra to submit homework's/assignments	0	2.1	2.1	0.7	95.2	516.3	S
36. I use Midas class.	1.4	6.8	11.6	6.8	73.3	262.9	S
37. I use Midas Class for mathematics learning.	0.7	6.2	14.4	11	67.8	216.3	S
38. I use Midas class to self-preparation for mathematical concepts.	1.4	7.5	12.3	8.9	69.9	231.4	S
39. My teacher uses Midas Class to show any mathematical concepts by projector for beater teaching and learning.	0	4.1	15.1	8.9	71.9	255.2	S
40. My teacher refers us to use Midas for mathematics learning.	1.4	3.4	17.8	8.2	69.2	232.4	S

41. My teacher refers us to use Midas for developing creativity and mathematics learning.	0.7	5.5	16.4	11.6	65.8	201.5	S