Chapter I

Introduction

Background of the Study

The world is changeable day-to-day with the development of Information and Communication Technology (ICT). It has become common place entities in all aspects of life. Across the past twenty years, the use of ICT has fundamentally changed the practices and procedures of nearly all forms of endeavor within business and governance. The communication trends of all the sectors, education, science business, industrial and society has been fundamentally upgraded and changed with the innovation of information communication technology. All the people feel easy and fun to do any work anywhere. Both the teaching and learning activities have become increasingly technology based. Most of the educational researches emphasis on using ICT in teaching and learning activities in to the classroom. Therefore, technology plays vital role in our day-to-day life.

The source that helps to do any work easy, fast and systematic way is considered as an ICT. Information and communications technologies are computer based tools used by people to work with information and communication processing needs of an organization. Its purview covers computer hardware and software, the network, and other digital devices like video, audio, camera, and so on, which convert information (text, sound, motion, etc) into digital form (Moursund & Bielefeldt, 1999). Also United Nations report 1999, as cited in Amin, 2012) supports that ICTs cover Internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centers, commercial information providers, network-based information services, and other related information and communication activities. Moreover,

UNESCO (2002), information and communication technology (ICT) may be regarded as the combination of 'Informatics technology' with other related technology, specifically communication technology. Thus the ICT covers IT and other media. It has opened new avenues like, online learning, e-learning, virtual University, e-coaching, e- education, e-journal etc.

In this globally changing phenomenon of technology use, there is a rising attitude in Nepal to integrate technology in educational delivery. National Centre for Educational Development (NCED) has been providing training to the teacher through National Radio and FM; Computer science has been taught as an optional subject in school (grades 9 to 12); Computer Engineering/Computer Science/ ICT programme in Bachelor's and Master's Levels are run by different colleges under various universities; various Training Institutes conduct technical education and vocational training courses in computer and ICT; Tribhuvan University has started Bachelor's in Education program in computer science. One Laptop per Child (OLPC) pilot project in selected 26 schools of six districts. 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 Science subjects (MOE, 2013). Therefore, ICT has been practiced in many aspects like formal, informal and distance education from basic level to university level in education industry.

Technology use is supportive in the discipline of mathematics education. It is used often though as tedious, boring, and abstract and rout learning subject. According to NCTM (2000), technology is essential in teaching and learning mathematics where it can influence the mathematics that is taught and enhances students' learning. Besides that, technology can also help students to furnish their visual images of mathematical ideas, organizing and analyzing data, and can compute efficiently and accurately.

Technology can support students to investigate in every area of mathematics, such as geometry, statistics, algebra, measurement, and number.

Most of the mathematicians these days think about that ICT use promote both affective and cognitive part of mathematics. Research evidences also significantly growing to over cross the traditional thought of mathematics. When technological tools are available, students can focus on decision-making, reflection, reasoning, and problem solving. Students can also benefit in different ways from technology integration into everyday teaching and learning. New learning opportunities are provided in technological environments which potentially help students to engage with different mathematical objects and level of understanding. "ICT also adds a new dimension to the teaching and learning of Mathematics by helping students to visualize certain mathematical concept" (Voorst, 1999). He has also claimed that the visualization and exploration of mathematical objects and concepts in multimedia environments can foster understanding in new ways.

After years of exercising the annual system, the Tribhuvan University from the year 2014, re-introduced the semester system at its University Campus central departments of education Kirtipur, Kathmandu, Nepal. Semester system is not only an examination system but also education system. The main objective of this system is to enhance students' knowledge, skill and capacity continuously, extensively and in-depth. The regular attendance is must in semester system. Actually, the provision of frequent class tests and regular evaluation compels students to keep themselves updated all the time. As a result, the students become more study-oriented, creative and responsible for their own learning. The internal evaluation, classroom presentation and final evaluation also increase the quality in semester system. Therefore, semester

system is very beneficial, increase the confidence level and develop the creativity of the students.

Tribhuvan University lunched the fourth semester of first batch in mathematics education there are total of five subjects. Among them three are compulsory and two subjects are elective, they are ICT in mathematics Education and Operational Research. Between these two subjects, many students had chosen and interested to ICT in mathematics education and few students were interested with the subject operational research. So this is the curiosity why many students like ICT in Mathematics Education. It really enhances the quality in mathematics education?What are the student's attitudes towards: ICT curriculum, teaching learning activities of ICT classes, application of ICT tools, ICT lab, availability of internet facilities and evaluation system of ICT in mathematics education? Similarly, many researchers have concluded that students are more interested with ICT. Therefore, these profiles mentioned above help to measure the attitude of students towards ICT in mathematics education.

Statement of the Problem

Nepal is a developing country, which is still behind in employing technology for learning mathematics. The government of Nepal emphasis integrating technology in teaching and learning mathematics (MOE, 2072). The ICT course has been practiced in basic level to higher level of mathematics education. The course ICT in mathematics education has been lunched in the fourth semester in Tribhuvan University. Many students are interested to study it. But why they are interested? As a student, researcher found that, master level students feel mathematics as a boring subject and harder one because when they start solving problem of mathematics then they are not able to visualize. ICT uplift the learning of the students by visualizing the mathematical problem. We can get the information very fast of the world and keep the people update

in new emerging problems. The researcher found that it has a lot of benefit and need and call of the day, so it should be lunch in other universities in mathematics education. Why we don't ready to lunch it in other universities? For the implementation of this curriculum in other universities, student's perception and attitude is most important. After study of thesis of Sarita Pandey and Rozy Shrestha the researcher was also motivated to select the current topic. Both the thesis focused attitude of teachers towards ICT and its status respectively. So there is knowledge gap of student's attitude. To find out the attitude of students towards the ICT in mathematics education, it is described in theprofiles attitude of ICT curriculum, teaching learning activities, application of ICT tools, availability of internet facilities and evaluation system. For that, the study was concerned the following specific research questions.

- What is the attitude of master level students towards use of ICT in mathematics education?
- Do the boys and girls have the different attitude towards use of ICT in mathematics education?

Objectives of the Study

Every research needs the objectives. Without the destination, nothing can be achieved. Therefore, the researcher was keen interested to meet the following objectives.

- To find out the attitude of master level students towards ICT in mathematics education.
- To compare the attitude of students towards ICT in mathematics education with respect to gender.

Research Hypothesis

The attitude of master level students towards ICT in mathematics education is positive in term of achieving mathematical knowledge through the new technology ICT, with the comparison of traditional technology.

Statistical Hypothesis

The statistical hypothesis of the study is as follows.

- Null Hypothesis: There is no significance difference between the attitude of boys and girl'sstudents towards ICT in mathematics education.
- Alternative Hypothesis: There is significance difference between attitude of boys and girl's students towards ICT in mathematics education.

Significance of the Study

Mathematics education is changing as it seeks new way to improve mathematics instruction quality for learners. This shift is occurring simultaneously as mathematics education research is experiencing both new methods emerging and widespread implementation of several information technology advancements. This age 'information age' the growth of technology and software oriented education system guide educators to explore new teaching methods that can be used at University, elementary, secondary and college classroom environments as an alternate to teacher directed techniques. This is the paradigm shift from traditional teaching and learning to the modern. This research is beneficial to the stakeholder, teacher, policy maker, and to those who are interested in the mathematics field.

The use of ICT in mathematics education can make the teaching process more effective as well as enhance the student's capabilities in understanding basic and innovative ideas about every branches of mathematics. This study has the following significance.

- Better understanding of mathematics education.

- To understand the attitude of students towards ICT in mathematics education.
- It also helpful for improve the teaching learning situation in the context of negative attitude and further research towards ICT in mathematics education.
- This study provided the important information to the instructor in using ICT in mathematics education.
- It was helpful for national policy maker, mathematics curriculum administrators, and all other concerned personal dents to it.

Delimitation of the Study

Delimitation are boundaries that are set by researcher in order to control the range of the study. They are as follows.

- This study was concerned in master level of Tribhuvan University in Nepal.
- This study included only the master level students of ICT in mathematics education.
- This study contained 100 (85 boys and 15 girls) students of Tribhuvan University in Nepal.
- This study was concern with students who use or study ICT in mathematics education.

Operational Definition of Related Terms

An operational definition are such types of terms which decide to measure the variables in the study.In another way operational definition is the articulation of operationalization (or statement of procedures) used in defining the terms of a process needed to determine the nature of an item or phenomenon and its properties.In this study the following are the operational terms of the study.

ICT. Information and communication technology regarded as a combination of 'informatics technology' that enhance the learning opportunity and secure the quality in

education. In this study, ICT refers audio, video and internet teaching and learning tools by the help of which we get more information fast, easy and systematic way than traditional materials in mathematics education.

Attitude. An attitude is the complex affair which cannot be wholly described by a single numerical index. "It is a learned tendency or predisposition respond in a consistently positive or negative manner to some concept, situation or objects" (Aiken, 1996. as cited in Khanal, P. 2014). In this study the concept of attitude is used to denote person's inclination, feeling, ideas, opinions, beliefs and concepts about use of ICT curriculum, teaching learning activities of ICT classroom, application of ICT tools, availability of internet facility and evaluation system of ICT in mathematics education.

Master Level Students. The persons whohave studied in master level University Campus Tribhuvan University central department of mathematics education.

Mathematics Education. Mathematics is a branch of science. It is the numerical and calculation part of human life and knowledge. It also has been defined as the science of number and science as calculation. It is related to measurement, calculation discovering relationship and dealing with the problems of space. It is a system which organized and exact branch of science. In this study mathematics educations means that education of mathematics which is learned by using ICT and its materials.

Boys. The male students who have studiedICT in mathematics education in master level.

Girls. The female students who have studiedICT in mathematics education in master level.

Chapter II

Review of Related literatures

The review of related literature is an important and essential for guideline of study. It helps to the researcher to get more information, ideas and identifying what people already have been done? In addition, what we have to find out and tested? "It eliminates the duplication of what has been done and provides useful hypothesis and helpful suggestions for significant investigation" (Best and Kahn, 2012, P. 39). Therefore, for selecting design, sample, tool, data collection procedure, analyzing data and making decision, it gives instruction and makes a reliable research.

Empirical Literature

The review of the empirical literatures connects the systematic summary of scientific researches and real investigations including their topics, the reasons why this study is conducted, methods of the study, data collection tools and methods of confirming their validity and reliability, and major findings in the related field. It guarantees that the researcher appraises of the scientific investigation and systematic study, its ways and required procedures for it.

The major propose of the present study finds the attitude of students towards ICT in mathematics education and compare it with gender wise. There are so many journals, reports and related research studies. So, researcher was reviewed these studies in order to explain the present problem of the study. They are as follows.

A study carried by Yusuf & Balogun (2011) entitled "Student teachers' competence and attitude towards information and communication technology" to examined empirically student-teachers' competence and attitude towards information and communication technology. Gender influence on their competence and attitude were also examined. The design of the study was survey type. The data were collected from 382 student-teachers (181 males and 201 females) from the Faculty of Education, University of Ilorin, Nigeria by using random sampling method. To examine the

validity and reliability of tools the initial draft was administered on 50 student teachers. The feedback obtained from this first administration was used to revise the final instrument and final instrument was tested for reliability using test-retest method of three weeks' interval. The data collected through a questionnaire and were analyzed using percentages, means, and chi-square statistics. The results indicated that majority of the student-teachers have positive attitude towards the use of ICT and they are competent in the use of few basic ICT tools. Overall, no significant difference was established between male and female student-teachers' attitudes and use of ICT.

Barreh (2015) studied entitled "Students' attitudes and perceptions toward the effectiveness of mobile learning" to determine the students' attitudes and perceptions toward the effectiveness of mobile learning using SMS and facebook. The design of the study was survey type and data were collected 105 respondents enrolled in the second year course entitled "Internet Technology," taught in the Department of Mathematics and Computer Science using survey of quantitative data was obtained through a questionnaire based on close-ended questions using five-point Likert scale. The data were analyzed by finding percentage of each responses. The findings indicate that mobile learning using SMS and facebook could be used as supplemental tools to enhance students' learning to achieve their learning outcomes.

Both of the literature mentioned above emphasis the attitude of students towards ICT and its tool mobile learning. Findings indicated that ICT and its tool mobile learning enhance the students learning and have a positive attitude towards both of them. But these researches show the importance of ICT in learning and give guideline and evidence for this research. So review of above research is important for this investigation.

Similarly, Rajagopal & et al., (2015). entitled "Attitude of secondary students towards the use of GeoGebra in learning loci in two dimensions." This paper studies the attitude of form two students towards the utilization of GeoGebra in learning Loci in Two Dimensions. This study was conducted with 30 form two students from a secondary school. In the beginning, GeoGebra was used to teach Loci in two dimensions and then followed by a survey. Questionnaires were provided to investigate the attitude of the students towards GeoGebra. These tools ware validated by Cronbarch's alpha for all the items and past studies had used all of the measures of constructs. A research model which was modified from the Technology Acceptance Model (TAM) was used to develop the questionnaires in order to study the students' attitude. Later on, the data were analyzed by using Statistical Packages for Social Sciences 19.0 (SPSS) software to find the correlation coefficient and regression results. The result revealed that the students showed positive attitudes towards the use of GeoGebra in learning Loci in Two Dimensions. At the same time, there was a significant relationship between perceived ease of use, perceived usefulness and attitude of students towards GeoGebra.

Moreover, Wafa et al., (2009). entitled "University students' attitudes towards cell phone learning environment" to investigate Jordanian university undergraduate and graduate students' attitudes towards the learning environment where cell phones are used as learning tools in classroom. The design of the research was survey. The data were collected from 134 students among the two groups (undergraduate and graduate). Each group has its own questionnaire with five degrees of expressing agreement. To achieve this goal, the researchers distributed two questionnaires among two groups of two different levels of randomly chosen university students at the Faculty of Educational Sciences at Al-al-Bayt University. The data was analysed by using

statistical tools average value, standard deviation and t- test. The findings indicate that undergraduates are more favorable to cell phone environment than graduate students. The study also reveals that cell phone has more influence on male students than on female students.

The above literature focused on the attitude of different level students towards ICT tools like Geogebra and cell phone in teaching and learning mathematics respectively. These researches also focused on ICT and use of its tools is very important for learning mathematics. This research also tries to find out attitude of students towards ICT in mathematics education and compare it with gender wise. The attitude and comparison may be differing from this research in my research. But this researchhelps for evidence and selecting design, population, sample, tools of data collection, procedure of data collection, data analysis procedure and to make conclusion. Therefore, researcher has reviewed these researches.

In addition, Rodulfo, et al., (2015). completed a study entitled "Students' perception and attitude on ICT integration in mathematics classroom" to investigate how mobile gadgets were utilized inside a mathematics classroom during the teaching-learning process. With 93 sample students, using survey design. Findings indicates that students have a positive attitude towards mathematics, agreed if ICT will be integrated in the teaching-learning inside the classroom, still agreed after the ICT integration and evaluated the ICT integration as effective. Moreover, there is an increased level of agreement of the students and significant relationship between the students' attitude towards Mathematics and the students' perception on ICT integration inside the classroom.

Another study carried by Ayebi (2010) entitled his topic "Relationship between students' attitudes toward ICT and their achievement in ICT" to investigate statistical

relationship existed between academic achievement and achievement of students in ICT. This was the survey type of the study among eleven females and sixteen male undergraduate students offering B.Ed. Health Science Education and twenty-twofemales and thirty-threemales in Computer Applications in Education course of postgraduate students. Questionnaire was the tool of this study measured with five point Likert scale. The instrument was pilot tested and Cronbach alpha test was used for reliability and validity on M.Phil students in the School of Agriculture, University of Cape Coast. The responses on the attitude scale were scored and analyzed using Spearman correlation, means, standard deviation and means of the responses and multiple regression analysis. It concluded that there was no difference between the mean scores of the undergraduate students and postgraduate students. About Students' attitudes toward ICT both postgraduates and undergraduate students both showed positive attitudes towards ICT.

Similarly, the above literature also focused the attitude of students and their relationships towards ICT in different subjects including mathematics. The result indicated that ICT and its tool are more beneficial for teaching and learning activities and there was no difference between the mean scores of the students towards ICT. So, these reviews are completely related to this study and give a guideline and evidence for present research.

Finally, Santilla (2013) entitled "Attitude and behavioral among student's computer and mathematics." The purpose of this study was to examine the relationships between students' attitudes towards mathematics and technology. The design of the study was survey and data was collected from 164 students of different profiles and mainly focused financial mathematics. Questionnaire of Galbraith and Haines (1998) was used and measured on a Lickert scale. In order to determine the reliability of

instrument was used Cronbach alpha method. Questionnaire was applied face to face to undergraduate students of several profiles. Statistical procedure was used the factorial analysis with an extracted principal component in order to measure data. The test χ^2, Bartlett's test of sphericity, KMO (Kaiser-Meyer Olkin) was used to analysis data. This paper shows how mathematics confidence, motivation mathematics, computer confidence, computer motivation, computer-mathematics interaction and mathematics engagement help to understand the students' attitude toward mathematics and technology. Therefore, the result indicated that there are factors that contribute to understand the students' attitude towards mathematics and technology.

These various research studies have been carried out in the field of ICT in mathematics Education. Yet researcher felt a lot of gap prevailing in these various researches carried out. There is the knowledge gap between ICT and mathematics education. Still researcher can claim that this research is quite different. Present research is also similar with them in a sense that all of these researches including mine are concerned with the ICT in mathematics, which helps to change student's attitude towards mathematics. This research also focuses on the same matter.

Theoretical Literature

Researches and theories are interrelated and inseparable. A theory provides a conceptual framework for research in term contribute to the development of theory. A theory plans and directs the research studies. Any philosophies must be supported by any theory for its pedagogical implementation. Likewise, the use of supported by many theories. All aspects of this research are related to constructivism theory.

Constructivism

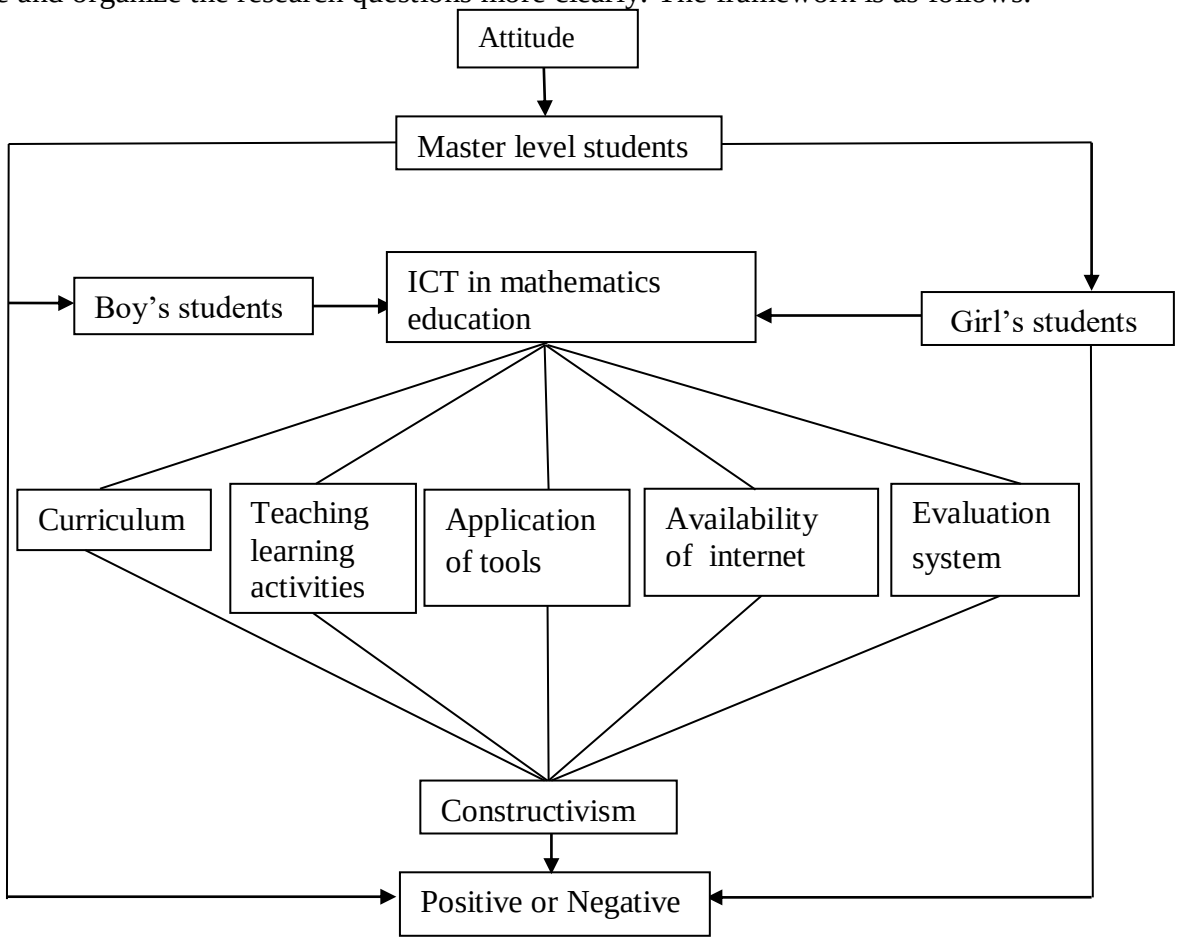
The word “construct” is to build or make something. We always use this word in our daily life. In the field of education, “construct” means to develop an idea or belief that is based on various pieces of evidence, which are, introduced in teaching/learning field. The “constructivism” has also developed 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 a new knowledge as they interest with their environment. Constructivist theory of learning beliefs 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 symbolically constructed by the learners who are making their own representation of action. The guideline principle of constructivist learning theories is the learners own active initiative and control on learning and personal knowledge construction that it self-regulation of learning.

Most of the educators utilizing a constructivist perspective many 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 participating in classroom. In constructivist classroom students try to find the solutions of the problem by learning in a group where students are motivated to do their work themselves and find the solution and teacher work is just to facilitate the students. By using ICT in math classroom students develop their knowledge by realizing and here teacher role is just a facilitator. Further in this type of constructivist class students are motivated to share their ideas expand their knowledge through ICT or by utilizing their experience.

Therefore, all the domains of this research: ICT curriculum, teaching and learning activities in ICT classroom, application of ICT tools, availability of internet facility and evaluation process of ICT in mathematics education completely related to constructivism theory that emphasis the active role of learner and teacher role as an instructor or facilitator. All in all, ICT supports constructivist pedagogy where students use technology to explore and reach understanding of mathematical concepts where it promotes higher order thinking and better problem solving strategies.

Conceptual Framework

Theory and conceptual framework are interrelated. A theory provides a conceptual framework.A conceptual framework is presented either in graphical or narrative forms which depicts the relation between the variables, brings clarity, focus to see and organize the research questions more clearly. The framework is as follows.



(United Nations Report 1999, as cited in Amin, 2012)

From the above review of literature and the theoretical model, the researcher has come to the point that the topic of current research attitude of master level students towards ICT in mathematics education. The above mentioned literatures have helped the researcher to save the research and draw meaningful conclusion. According to United Nations report 1999, as cited in Amin (2012) ICTs cover internet service provision, telecommunications equipment and services, information technology equipment and services, media and broadcasting, libraries and documentation centers, commercial information providers, network-based information services, and other related information and communication activities. The main purpose of the research is to find the attitude of students and compare it with gender wise towards ICT in mathematics education. For that the attitude and students gender are interrelated. The attitude about curriculum, teaching learning activities, application of tools, and availability of internet and evaluation system are the main domain of the study. So, they determine the attitude of ICT in mathematics education. All these aspects create the constructivism learning theory so, the conceptual framework of this study is based on these aspects and constructivism theory. The research concludes that positive or negative decision in the whole.

Chapter III

Methods and Procedure

Methodology is the useful bridge to solve the research problem in systematic way. "Methodology is a technique for scaling objects or statements" (Stephenson, 1953. as cited in Best & Kahn, 2012). The methodology describes the methods and process applied to the entire aspect of the study. In other words, methods are the way to gather information. We must have population of the study for the designing of methods. Representative group is selected for the true experimentations. Different tools and techniques are used in different phase of the study. Thus the framework of this chapter contains design of the study, population, sample, tools of data collection, validity and reliability of tools, procedure of data collection and data analysis procedure.

Research Design of the Study

This study was concerned with mixed method which considers both quantitative and qualitative methods. According to Cresswell (2009), a mixed method approach is an approach to inquiry that combines or associates both qualitative and quantitative forms. This approach assists the researcher to come up with the findings that are more comprehensive, holistic and integrates various aspects of the problem investigated. The first part of this study was quantitative research. The research design helps the researcher for suitable planning and provides guideline for collection of data. For the first part the researcher was adopted the survey design in this study. "The survey type research studies with large population or universal setting and studies samples chosen from the population to discover the relative incidence distribution and inter relations of sociological and psychological variable" (Kerlinger, 1973, p.410). Survey research is probably best adopted in obtaining personal and social facts, beliefs, concepts and opinions. So, the researcher was applying survey design to find out the attitude of

master level students towards ICT in mathematics education. To ensure the positive attitude of students, the researcher used qualitative nature.

Population and Sample of the Study

This study was focused on the investigation of attitude of master level students towards ICT in mathematics education. Until now, there are nine universities in Nepal (MOE, 2072). Among them Tribhuvan University is one of the popular and oldest university. Therefore, master level students of Trivhuwan University are the population of this study in Kathmandu district. The sample of this study were selected by using random sampling procedure. In first phase one hundred students of Tribhuvan University Central Campus Kirtipur, Kathmandu in mathematics education are the sample of study.In the second phase, purposive sampling method was used to select four students who responded to the interview questions.

Tools of the Data collection

Tools are important factors for collecting the data. There were different types of tools for collecting datawhich as follows:

Questionnaire. "Questionnaire is a device consisting of a series of questions dealing with some psychological, social, educational topic sent or gives to an individual or a group of individuals with the object of obtaining data with regarded to some problems under investigation" (Koul, 2000, as cited in Khanal, 2015). Since the research is quantitative research, so tool of this research were questionnaire. Teacher's attitudes towards ICT Scale developed by (Mehara and Far, 2013) was modified to measure the attitude of students and used in this research. The questionnaire contains 50 (positive and negative) items on the domains use of ICT curriculum, teaching learning activities of ICT classroom, application of ICT tools, availability of internet facility and evaluation system of ICT in mathematics education. It was designed as 5-

point Likert's scale, where positive statements, 1 for strongly disagree to the concept, 2 for disagree to the concept, 3 for undecided to the concept, 4 for agree to the concept, and 5for strongly favorable to the concept and vice versa.

Interview. Interview is two-way interaction between two or more persons. It is a data collection procedure including verbal communication between the researcher and respondent by telephone or face to face situation. 'The interview sequence follows the same progression-one usually starts by engaging the consultant in an open-ended interview, posing general indirect or grand tour questions first. The researcher prepaid interview guideline (open ended interview questions) on the basis of the suggestion from supervision and the study of research book. Interview is a kind of widely used data collection method of educational method. It is also a kind of oral questionnaire which help us to understood participants' perception reaction view and her/ his facial expression about the attitude towards ICT in mathematics education.

Validity and Reliability of Tools

For the validation of tools researcher were constructed the questionnaire formand interview guideline which was based on conceptual framework. To ensure the validity of the instruments, the researcher consulted with the thesis supervisor. The tools were being fixed for the final study. Its reliability was ensured by taking pilot test among thirty students, which were not included in the study. For reliability, obtained data were calculated using the Statistical Package for Social Sciences (SPSS) programmer, version 21.0 setting at 0.05. The Cronbach's α reliability coefficient was found 0.93.

Data Collection procedure

Data is the foundation and mirror of the research. It shows the opinions, concepts, attitude of the respondents. Therefore, collection of reliable data is very

essential for all kinds of researches. For this study, the researcher was visited the sampled campus University Campus Kirtipur, Kathmandu. The researcher visited the principal and students of the respective campus and was asked for permission before administering the questionnaire to the students.

The researcher personally collects the data from the respondents of individual and in groups. While collecting the data the researcher told the title, purpose of research reasons to select the topic and methods to fill the questionnaire and then distribute the questionnaire. Some respondents filled the questionnaire at the same time and rest of the questionnaire is collected after four -five days of distribution. For the interview the researcher noted points of interviewer and mentioned in paragraph.

Methods of Data Analysis and Interpretation.

This is mixed design research so; it was based on both quantitative and qualitative nature. When collecting the data from questionnaire subject to statistical tests the researcher analyzed the collected data by the help of Statistical Package for Social Sciences (SPSS) software, version 21.0. To identify the attitude of students towards the ICT in mathematics education the researcher used chi-square test (χ^2) at 0.05 level of significance and percentage of each statement.For second objectiveto compare the attitude of students with respect to gender wise t- test, mean and standard deviation ware used at 0.05 level of significance.The responses from interviews were recorded and transcribed under headings and then were organized in themes and categories that emerged.

Chapter IV

Analysis and Interpretation of Data

This is a mixed study conducted in University Campus Kirtipur, Kathmandu. The main purpose of this study was to find out the attitude of master level students towards ICT in mathematics education and compare it with gender wise. This chapter is mainly concerned with the analysis and interpretation of data, which was collected from one hundred students from University Campus who studied ICT in mathematics education. The data gathered from different sources were analyzed and interpreted under five profiles: use of ICT curriculum, teaching learning activities of ICT classroom, application of ICT tools, availability of internet facility and evaluation system of ICT in mathematics education.

A set of questionnaire which are given in appendix-A consisting fifty of closed ended questions was developed as a research tool. The closed ended questions related to the attitude of students towards ICT in mathematics education were to be analyzed with five alternatives: strongly agree, agree, neutral, disagree, and strongly disagree. Regarding statistical description, measures of percentage and non-parametric chi-square (χ^2) test were used to measure attitude of students towards ICT in mathematics education and t- test mean and standard deviation were used to compare the attitude with respect to gender wise. The data were analyzed by using the Statistical Package for Social Sciences (SPSS) programme, version 21.0 setting at 0.05. While analyzing the data the total number of response of the students were counted and changed into percentage. If the responses were fifty percentages or above it was considered as positive attitudes and below, it was considered as negative attitudes. The responses of closed ended items were expressed in words and phrases are analyzed descriptively. In chi-square (χ^2) test and t- test the statements which have less value than the tabulated

value was significance and vice versa. If the chi-square value of each statements exceeded to 9.49, so the statements were being significant. Therefore, it was concluded that there was positive attitude of master level students towards ICT in mathematics education. The attitude was analyzed under the following headings.

Students Attitude towards Curriculum of ICT in mathematics education.

In this domain there were nine statements (1-9) related to the ICT curriculum. Among them, one statement (4) is negative. The following table consists the number of responses of student's attitude and corresponding percentage and their chi-square (χ^2)value of questionnaire.

Table 4.1 percentage and chi-square values

Statements		SA %	A %	N %	D %	SD %	χ^2	D
1	I would like to take ICT courses.	64	33	1	2	0	159.5	S
2	Often in class activities, we discuss pros of ICT into math curriculum.	16	46	23	9	6	50.9	S
3	I am extremely happy with ICT injected math curriculum.	45	46	9	0	0	111.1	S
4	Course contents of ICT are not sufficient to teach mathematics in secondary level.	9	56	17	14	4	85.9	S
5	ICT course helps for reducing math-learning anxiety.	33	43	13	6	5	58.4	S
6	ICT courses have been embedded math learning culture in outside of classroom.	9	52	34	5	0	98.3	S
7	ICT in mathematics provided me greater chance for minimizing misconceptions allied to the subject \matters.	11	65	22	2	0	141.7	S
8	Technological devices in the ICT	5	43	45	6	1	96.8	S

	course are sufficient for be causation on application.							
9	I am happy with the software equipment in my ICT curriculum.	34	39	4	21	2	56.9	S

Critical region $\chi^2_{\alpha,\ v} = \chi^2_{0.05,\ 4} \leq 9.49$ (Non-significant)

From the above table the statement, “I would like to take ICT courses.” is highly significant with the χ^2 –value 159.5 at 0.05 level of significance. A total of 97% of students are agreed and 1% of students are neutral and 2% are disagree about this statement. It shows that most of the students are highly positive for this statement.

On the statement "often in class activities, we discuss pros of ICT into math curriculum". About 62% of the students are agreed 23% are neutral and 15% of students are disagreed. This statement is significant with the χ^2 –value 50.9 at 0.05 level of significance. This shows that most of the students have positive attitude towards this statement.

On the statement “I am extremely happy with ICT injected math curriculum.” is significant with the χ^2 –value 111.1 at 0.05 level of significance. Total of 91% of students are agreed and 9% of students are disagreed about this statement. It shows that majority of students are positive for this statement.

On the statement “Course contents of ICT are not sufficient to teach mathematics in secondary level.” is significant with the χ^2 –value 85.9at 0.05 level of significance. A total of 65% of students are agreed and 17% are neutral and 18% of the students are disagree about this statement. It shows that majority of students are positive for this statement.

On the statement “ICT course helps for reducing math-learning anxiety.” is highly significant with the χ^2 –value 58.4at 0.05 level of significance. A total of 76% of

students are agreed and 13% are neutral and 11% of the students are disagree about this statement. It shows that most of students have positive attitude towards this statement.

On the statement, "ICT course have been embedded math learning culture in outside of the classroom." is significant with χ^2 –value 98.3 at 0.05 level of significance. 61% of the students are agreed 34% are neutral and 5% are disagree. This shows that most of the students are highly positive for this statement.

On the statement, "ICT in mathematics provided me greater chance for minimizing misconceptions allied to the subject matters." is highly significance with χ^2 –value 141.7 at 0.05 level of significance. A total of 76% of students are agreed and 22% are neutral and 2% of the students are disagree with this statement. It concluded that majority of students have positive attitude with this statement.

On the statement, "Technological devices in the ICT course are sufficient for be causation on application". is significance with χ^2 –value 96.8at 0.05 level of significance. 48% of students are agreed and 45% are neutral and 7% of the students are disagree with this statement. It concluded that miscellaneous have not positive attitude with this statement. It means this statement have also good attitude of students.

On the statement, “I am happy with the software equipment in my ICT curriculum.” is highly significant with the χ^2 –value 56.9 at 0.05 level of significance. A total of 73% of students are agreed and 4% of students are neutral and 23% are disagree about this statement. It shows that majority of students are positive for this statement.

Hence, from the analysis of the data, majority of the students had positive attitudes towards positive statements and negative towards negative statements. So, it is concluded that majority of master level students in mathematics had positive attitudes towards ICT curriculum. Also χ^2 –value of each statement is significant. So researcher claimed that ICT included curriculum is best for better achievement.

Students Attitude towards Teaching Learning Activities of ICT in mathematics education.

There were fourteen statements (10-23) related to teaching learning activities of ICT. Among them statement nineteen is negative and other are positive. The following table consists the student's attitude and its corresponding χ^2– value of the questionnaire.

Table 4.2 percentage and chi-square values

Statements		SA %	A %	N %	D %	SD %	χ^2	D
10	Use of ICT in the mathematics classroom would make the subject matter more interesting.	38	47	13	2	0	91.3	S
11	ICT can increase collaboration (co-operation) between students.	15	65	13	3	4	132.2	S
12	My confidence in mathematics is more increased by taking different software activities in mathematics learning.	14	58	26	2	0	112.0	S
13	ICT gives opportunity to learn more in mathematics.	34	47	16	3	0	81.5	S
14	After using ICT I feel it change the way students learning in mathematics classroom.	10	53	34	2	1	103.5	S
15	Using ICT improves quality of problem solving strategy in mathematics.	5	45	41	4	5	88.6	S
16	ICT helps me to select appropriate strategy for my own. learning.	15	51	20	6	8	66.3	S
17	Virtually manipulation nature of ICT enforces me to revise any contents.	13	56	21	6	4	89.9	S
18	ICT is useful in mathematics learning owing to its simplicity for	10	44	34	11	1	65.7	S

	disseminating information.							
19	I think that the usage of ICT restricts the creativity of the students.	4	17	7	46	26	57.3	S
20	Involving in technologically enhanced learning activities I can visualize mathematical objects.	17	43	34	3	3	65.6	S
21	Learning with computers offers real advantages in terms of learning styles.	23	38	32	7	0	32.3	S
22	We have administrative support for adopting ICT into learning processes.	21	47	12	15	5	52.2	S
23	The more I experience ICT, the fewer problems I face in learning.	65	22	7	4	2	138.9	S

Critical region $\chi^2_{\alpha,\ v} = \chi^2_{0.05,\ 4} \leq 9.49$(Non-significant)

From the above table the statement, “use of ICT in the mathematics classroom would make the subject matter more interesting.” is highly significant with the χ^2–value 91.3 at 0.05 level of significance. A total of 85% of students are agreed and 13% of students are neutral and 2% are disagree about this statement. It shows that most of the students are highly positive for this statement.

On the statement “ICT can increase collaboration (co-operation) between students.” is highly significant with the χ^2–value 132.2 at 0.05 level of significance. 80% of students are agreed and 13% of students are neutral and 7% are disagree about this statement. It concludes that most of the students have positive attitude for this statement.

On the statement “My confidence in mathematics is more increased by taking different software activities in mathematics learning.” is highly significant with the χ^2 –value 112 at 0.05 level of significance. A total of 72% of students are agreed and 26% of students are neutral and 2% are disagree about this statement. It shows that most of the students are highly positive for this statement.

On the statement “ICT gives opportunity to learn more in mathematics” is highly significant with the χ^2–value 81.5 at 0.05 level of significance. A total of 81% of students are agreed and 16% of students are neutral and 3% are disagree about this statement. It means that majority of the students have positive view for this statement.

On the statement “After using ICT I feel it change the way students learning in mathematics classroom.” is highly significant with the χ^2–value 103.5 at 0.05 level of significance. A total of 63% of students are agreed and 34% of students are neutral and 3% are disagree about this statement. It shows that most of the students are accepted the statement.

On the statement “Using ICT improves quality of problem solving strategy in mathematics.” is highly significant with the χ^2–value 88.6 at 0.05 level of significance. A total of 50% of students are agreed and 41% of students are neutral and 9% are disagree about this statement. It shows that most of the students have positive attitude with this statement.

On the statement “ICT helps me to select appropriate strategy for my own. learning.” is highly significant with the χ^2–value 66.3 at 0.05 level of significance. A total of 66% of students are agreed and 20% of students are neutral and 14% are disagree about this statement. It shows that most of the students have positive attitude with this statement.

On the statement “Virtually manipulation nature of ICT enforces me to revise any contents.” is significant with the χ^2–value 89.9 at 0.05 level of significance. A total of 69% of students are agreed and 21% of students are neutral about this statement and 10% of them are disagree. It shows that most of the students are highly positive for this statement.

On the statement “Virtually manipulation nature of ICT enforces me to revise any contents.” is significant with the χ^2–value 65.70 at 0.05 level of significance. A total of 54% of students are agreed and 34% of students are undecided about this statement and 12% of them are disagree. It helps the researcher to conclude that most of the students have positive attitude this statement.

On the statement “I think that the usage of ICT restricts the creativity of the students.” is significant with the χ^2–value 57.30 at 0.05 level of significance. A total of 21% of students are disagreed and 7% of teachers are neutral and 72% of them are disagree about this statement. It shows that most of the students are highly positive for this statement.

On the statement “Involving in technologically enhanced learning activities I can visualize mathematical objects.” is significant with the χ^2–value 65.60 at 0.05 level of significance. A total of 60% of students are agreed and 34% of students are undecided about this statement and 6% of them are disagree. It helps the researcher to conclude that most of the students have positive attitude this statement.

On the statement “Learning with computers offers real advantages in terms of learning styles.” is significant with the χ^2–value 32.3 at 0.05 level of significance. A total of 61% of students are agreed and 32% of students are undecided about this statement and 7% of them are disagree. It helps the researcher to conclude that most of the students have positive attitude this statement.

On the statement “We have administrative support for adopting ICT into learning processes.” is significant with the χ^2–value 52.2 at 0.05 level of significance. A total of 68% of students are agreed and 12% of students are undecided about this statement and 20% of them are disagree. It helps the researcher to conclude that most of the students have positive attitude this statement.

On the statement "The more I experience ICT, the fewer problems I face in learning." is highly significant with the χ^2 –value 138.9 at 0.05 level of significance. A total of 87% of students are agreed and 7% of students are undecided about this statement and 6% of them are disagree. It helps the researcher to conclude that most of the students have very good positive attitude with this statement.

From the above analysis each statement was highly significant. Hence, most of the students have positive attitude towards teaching learning actives of ICT in mathematics.

Students Attitude towards Application of ICT Tools in Mathematics Education.

The researcher included six statements (24-29) in this section to identify the attitude of students towards application of ICT tools. Among them statement 28 is negative.

Table 4.3 percentage and chi-square values

Statements		SA	A	N	D	SD	χ^2	D
24	ICT increase the motivation of students by taking it as an instructional tool.	28	52	16	3	1	87.7	S
25	I have no difficulty in operating the basic functions of GeoGebra and Mathematica.	7	22	11	41	19	34.8	S
26	I can use ICT tools like Web Camera, Printer and projector for my own learning.	10	43	10	34	3	60.7	S
27	ICT tool makes learning easier.	71	19	8	2		173.5	S
28	I am not happy with the software programs in my learning mathematics.	5	54	4	25	12	86.3	S
29	I feel funny to operate mathematical function of computer.	25	53	17	4	1	87	S

Critical region$\chi^2_{\alpha,\ v} = \chi^2_{0.05,\ 4} \leq 9.49$(Non-significant)

Above table states that "ICT increase the motivation of students by taking it as an instructional tool." is highly significant with the χ^2 –value 87.7 at 0.05 level of significance. A total of 80% of students are agreed and 16% of students are undecided about this statement and 4% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement "I have no difficulty in operating the basic functions of GeoGebra and Mathematica." is significant with the χ^2 –value 34.8 at 0.05 level of significance. A total of 29% of students are agreed and 11% of students are undecided about this statement and 60% of them are disagree. It concludes to the researcher students had faced problem to operate the functions of ICT tools like GeoGebra, Mathematica and other. So all students have not positive view with this statement.

On the statement "I can use ICT tools like Web Camera, Printer and projector for my own learning." is significant with the χ^2 –value 60.7 at 0.05 level of significance. A total of 53% of students are agreed and 10% of students are undecided about this statement and 37% of them are disagree. It helps the researcher to conclude that majority of the students have positive attitude this statement.

On the statement "ICT tool makes learning easier." is significant with the χ^2 –value 173.5at 0.05 level of significance. A total of 90% of students are agreed and 8% of students are undecided about this statement and 2% of them are disagree. It helps the researcher to conclude that majority of the students like to use ICT in mathematics education. Therefore, it has had positive attitude.

On the statement "I am not happy with the software programs in my learning mathematics." is significant with the χ^2 –value 86.30at 0.05 level of significance. A total of 59% of students are agreed and 4% of students are undecided about this statement

and 237% of them are disagree. It helps the researcher to conclude that we should use mathematics software properly and in systematic way to achieve the goal.

On the statement “I feel funny to operate mathematical function of computer.” is significant with the χ^2 –value 87 at 0.05 level of significance. A total of 78% of students are agreed and 17% of students are undecided about this statement and 5% of them are disagree. It helps the researcher to conclude that majority of the students have positive attitude this statement.

From the above analysis and interpretation, most of the statements had positive attitude of students towards application of ICT based tools and one statement "I have no difficulty in operating the basic functions of GeoGebra and Mathematica" had not positive attitude. Therefore, researcher concluded that students were faced problem to operate mathematical tools.

Students Attitude towards Use of Internet in mathematics education.

In this section the researcher included nine statements (32-38) related to use of internet in mathematics education to measure the attitude of master level students.

Table 4.4 percentage and chi-square values

Statements		SA %	A %	N %	D %	SD %	χ^2	Decision
30	I use internet for my daily class work.	17	41	24	11	7	35.8	S
31	Internet facilitates learning more attractive inside and outside of the class.	14	58	21	3	4	101.3	S
32	Using internet prevents me from	6	31	8	52	3	88.7	S

	socializing.							
33	Internet isolates students by discouraging social interactions among their friends.	6	51	31	4	8	83.9	S
34	Internet improves my learning satisfaction in mathematics.	3	35	11	45	6	70.8	S
35	Internet develop learning through sharing culture in mathematics.	8	71	16	5	0	169.3	S
36	The networking facility at my learning classroom is satisfactory.	2	13	8	67	10	141.3	S
37	I am motivated with internet facility in learning mathematics.	7	53	22	12	6	76.1	S
38	Using internet helps me to communicate mathematical information with my friends.	13	74	9	4	0	187.1	S

Critical region $\chi^2_{\alpha,\ v} = \chi^2_{0.05,\ 4} \leq 9.49$(Non-significant)

On the statement “I use internet for my daily class work.” is highly significant with the χ^2–value 35.8 at 0.05 level of significance. A total of 58% of students are agreed and 24% of students are undecided about this statement and 18% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement “Internet facilitates learning more attractive inside and outside of the class.” is highly significant with the χ^2–value 101.3at 0.05 level of significance. A total of 72% of students are agreed and 21% of students are undecided about this statement and 7% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement “Using internet prevents me from socializing.” is significant with the χ^2–value 88.7 at 0.05 level of significance. A total of 37% of students are agreed and 8% of students are undecided about this statement and 55% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, using internet helps socializing the students.

On the statement “Internet isolates students by discouraging social interactions among their friends.” is significant with the χ^2–value 83.9at 0.05 level of significance. A total of 57% of students are agreed and 31% of students are undecided about this statement and 12% of them are disagree. It concludes that most of the students were positive view with this statement.

On the statement “Internet improves my learning satisfaction in mathematics.” is significant with the χ^2–value 70.8at 0.05 level of significance. A total of 38% of students are agreed and 11% of students are undecided about this statement and 51% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, using internet is not only learning satisfaction in mathematics.

On the statement “Internet develop learning through sharing culture in mathematics.” is highly significant with the χ^2–value 169.3 at 0.05 level of significance. A total of 79% of students are agreed and 16% of students are undecided about this statement and 5% of them are disagree. It concludes that most of the students were positive view with this statement.

On the statement “The networking facility at my learning classroom is satisfactory.” is significant with the χ^2–value 141.30at 0.05 level of significance. A total of 15% of students are agreed and 8% of students are undecided about this statement and 77% of them are disagree. It concludes that most of the students were disagree they

have not positive view with this statement. Therefore, in ICT classroom the networking facility is most important.

On the statement "I am motivated with internet facility in learning mathematics." is highly significant with the χ^2 –value 76.1 at 0.05 level of significance. A total of 60% of students are agreed and 22% of students are undecided about this statement and 18% of them are disagree. It concludes that most of the students were positive view with this statement.

On the statement "Using internet helps me to communicate mathematical information with my friends." is highly significant with the χ^2 –value 187.1 at 0.05 level of significance. A total of 87% of students are agreed and 9% of students are undecided about this statement and 4% of them are disagree. It concludes that most of the students were positive view with this statement.

The above study on master level student's attitude shows that students have positive attitude towards ICT in mathematics education. But on the statements 32, 34 and 36 have not positive attitude. Therefore, using ICT helps students to socializing and to ensure quality of ICT in mathematics education internet is most important part.

Students Attitude towards Evaluation System ICT in mathematics education.

To find out the attitude of master level students towards evaluation system of ICT twelve statements (39-50) are given to the students and among them three statements 41,42, 47 are negative. So their percentage and chi- square value is given below.

Table 4.5 percentage and chi-square values

Statements		SA %	A %	N %	D %	SD %	χ^2	Decision
39	ICT helps an individuals' self-evaluation.	8	56	24	11	1	94.9	S

40	I am interested personally in developing my skills and knowledge in ICT as it is appropriate to my learning.	3	47	35	15	0	83.4	S
41	I feel insecure about my utilization of software ability.	1	65	11	12	11	130.6	S
42	Use of ICT in mathematics education reduces the personal treatment of students.	5	54	14	26	1	90.7	S
43	Practical skills only measured by ICT based Evaluation.	5	19	19	54	3	83.6	S
44	I am not satisfied with the administrative support on ICT in my classroom.	3	35	5	53	4	104.2	S
45	I believe that ICT improve the quality of mathematics education.	10	64	15	8	3	124.7	S
46	I feel my skills and knowledge in ICT are adequate for learning with ICT.	5	24	14	52	5	76.3	S
47	I find using ICT is time consuming.	2	15	12	61	10	109.7	S
48	Using ICT is often frustrating.	2	50	16	25	7	55.7	S
49	ICT helps me to finish work at a time.	9	60	18	12	1	107.5	S
50	ICT could increase my productivity in mathematics.	7	51	17	24	1	75.8	S

Critical region $\chi^2_{\alpha,\ v} = \chi^2_{0.05,\ 4} \leq 9.49$(Non-significant)

From the above table the statement “ICT helps an individuals’ self- evaluation.” is highly significant with the χ^2–value 94.90at 0.05 level of significance. A total of 64% of students are agreed and 24% of students are undecided about this statement and 12%

of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement “I am interested personally in developing my skills and knowledge in ICT as it is appropriate to my learning.” is highly significant with the χ^2 -value 83.40 at 0.05 level of significance. A total of 50% of students are agreed and 35% of students are undecided about this statement and 15% of them are disagree. It concludes that average of the students were positive view with this statement.

On the statement “I feel insecure about my utilization of software ability.” is significant with the χ^2 -value 130.60at 0.05 level of significance. A total of 66% of students are agreed and 11% of students are undecided about this statement and 23% of them are disagree. It concludes that most of the students were agree they have positive view with this statement. Therefore, students feel insecure about their utilization of software ability in ICT in mathematics education.

On the statement “Use of ICT in mathematics education reduces the personal treatment of students.” is significant with the χ^2 -value 90.7 at 0.05 level of significance. A total of 59% of students are agreed and 14% of students are undecided about this statement and 27% of them are disagree. It concludes that most of the students were agree they have positive view with this statement.

On the statement “Practical skills only measured by ICT based Evaluation.” is significant with the χ^2 -value 83.6at 0.05 level of significance. A total of 24% of students are agreed and 19% of students are undecided about this statement and 57% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, both practical and theoretical skill is measure in ICT in mathematics education.

On the statement “I am not satisfied with the administrative support on ICT in my classroom.” is significant with the χ^2 –value 104.2 at 0.05 level of significance. A total of 37% of students are agreed and 5% of students are undecided about this statement and 57% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, students are satisfied with the administrative support on ICT in their classroom.

On the statement “I believe that ICT improve the quality of mathematics education.” is highly significant with the χ^2 –value 124.7at 0.05 level of significance. A total of 74% of students are agreed and 15% of students are undecided about this statement and 11% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement “I feel my skills and knowledge in ICT are adequate for learning with ICT.” is highly significant with the χ^2 –value 76.3at 0.05 level of significance. A total of 29% of students are agreed and 14% of students are undecided about this statement and 57% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, they didn’t get adequate knowledge with ICT for learning mathematics education.

On the statement “I find using ICT is time consuming.” is significant with the χ^2 –value 109.7at 0.05 level of significance. A total of 17% of students are agreed and 12% of students are undecided about this statement and 71% of them are disagree. It concludes that most of the students were disagree they have not positive view with this statement. Therefore, using ICT in any subject is not time consuming.

On the statement “Using ICT is often frustrating.” is highly significant with the χ^2 –value 55.7 at 0.05 level of significance. A total of 52% of students are agreed and

16% of students are undecided about this statement and 32% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement "ICT helps me to finish work at a time." is highly significant with the χ^2 –value 107.5at 0.05 level of significance. A total of 69% of students are agreed and 18% of students are undecided about this statement and 13% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

On the statement "ICT could increase my productivity in mathematics." is highly significant with the χ^2 –value 75.8at 0.05 level of significance. A total of 58% of students are agreed and 17% of students are undecided about this statement and 25% of them are disagree. It concludes to the researcher most of the students had positive view with this statement.

From the above analysis and interpretation of this domain maximum number of students had positive attitude with the statements. But statements 43 and 46 had not positive attitude. Therefore, it concluded that ICT based evaluation system only not measure practical skills it measures both practical and theoretical skills of the students. And another statements concludes that ICT based skill is not sufficient to success in another.

Comparison of Boys and Girls Attitude towards ICT in Mathematics Education.

The boys and girl's students were asked 50 statements in as questionnaire (appendix-A) belonging towards the ICT in mathematics education. In this study the researcher established two objectives. Among them first objective previously analyzed by using χ^2statistics and percentage. But the second objective was to compare between the attitude of students towards ICT with respect to gender wise. For this purpose, the researcher has constructed the following null hypothesis (H_o).

There is no significance difference between the attitude of boys and girls towards ICT in mathematics education. To verify the hypothesis, the attitude score and mean of boys and girls given in Appendix-B and C respectively.

The mean attitude scores of boys and girl's students towards ICT in mathematics education are compared with the help of t-test, total mean score and standard deviation. From the appendix B and C

The result of the analysis is presented in the following table.

Comparison of Attitude of Boys and Girls Students towards ICT in Mathematics Education.

Table No.4.6Mean, standard deviation and t-value of boys and girl's students

	Sample (N)	Mean ($\overline{X}$)	Standard Deviation (S.D.)	D.F.	t-value
Boys	85	301.18	47.85	98	6.31
Girls	15	54.18	8.65		

In the above table N represents sample size, d.f. degree of freedom($N_1+ N_2-2 = 98$) at the level of significance 0.05 and the critical region ($t_{\alpha/2}, \nu = t_{0.025, 98} = 1.96$) of t-value. The null hypothesis is accepted if $-1.96 \leq t \leq 1.96$. Otherwise rejected. The analysis of the information mentioned in the above table represents there were 85 boys' students and 15 girls' students as sample. The grand mean response scores of boy's students are 301.18 and standard deviation 47.85. Similarly, the grand mean response score of girl's students is 54.18 and standard deviation 8.65. The difference mean views score between these two groups is 247. The calculated t-value with respect to the difference of mean views score is 6.31 which is does not lies between the tabulated t-value 1.96 at 0.05 level of significance. This shows that the alternative hypothesis is accepted and null hypothesis is rejected. Thus, it concluded that attitude

of boys' students and girl's students towards ICT in mathematics education in master level is not same.

Analysis ofQualitativeAttitude Towards ICT in Mathematics Education Using Interview

The first part of the research shows that there is a positive attitude towards ICT in mathematics education. Why it is positive? What is the reason behind it? In order to investigate the factors of ICT to be positive the researcher used interview guideline which were given in (Appendix D). The sample of the study (four students) for interview were selected by using purposive sampling.

It is the qualitative part, so the data analysis was based on student's views who were participated in the second phase of data collection. Using interview guideline, the information from the open-ended questionnaires provided from the experience of students the researcher was able to conclude the decision. The respondent opinions were recorded and transcribed under headings and then theywere concluded in themes and categories that emerged. The information collected from this tool has been presented as follows:

Students firstalready have positive attitude towards ICT in mathematics education. The researcher asked ten questions to the students in order to identify reason behind positive attitude towards ICT.

First student said that *"Yes am sure that the course content of ICT in mathematics education increase more knowledge and skills because it helps to logical reasoning power and creativity. I am also satisfied with the application of mathematical software to achieve the required objectives as there are adequate ICT materials and well managed in ICT lab. I have found different evaluation techniques in ICT which can improve the practical skills of students. After taking this course I am*

habitual to visualize the mathematical problem because there were effective learning activities in classroom and I get learning and sharing culture. As a whole I can confidently say that ICT can develop learning ability of students.

Second students also agreed with interview questions. He said that *"ICT in mathematics is a new subject and it uplift the student's ability like logical power, reasoning power and it shows the reality of mathematics. In our classroom there was good management of ICT materials like computers, smartboard,OHP and other components related to it. Yes, really we have developed learning through sharing cultures from ICT class and got some knowledge to visualize mathematical problems. But there is lack of internet access to make regularICT class which helps to search new things in mathematics education. In order to achieve the goals of ICT I have developed practical evaluation system because it create the constructive knowledge. So I am fully agreed this subject in mathematics education.*

Above student's view showed that ICT enhance the learning achievement of students, because ICT is new technology of teaching mathematics. It enhances the student's ability and adds new dimension in mathematics education. Therefore, talented as well as weak students also get benefits from the use of ICT in teaching mathematics.

Similarly, the researcher takes the interview of third students he said that *"The course content of ICT was key to understand mathematics. It has a lot of benefits and develop students logical power and skills. I am also satisfied with the use of ICT in mathematics. He adds more using Geogebra, Mathematica, OHP, PowerPoint in mathematics it is easy and fast way to handle the problem of mathematics there are adequate ICT materials and well managed in ICT lab. I have found different evaluation techniques in ICT which can improve the practical skills of students. After taking this course I am habitual to visualize the mathematical problem because there were*

effective learning activities in classroom and I get learning and sharing culture. As a whole I can confidently say that ICT can develop learning ability of students.

Student fourth replied that, "*ICT is a means of new technology which can upgrade the student's practical knowledge and technology skills. In our classroom ICT course is so effective from where we have able to build our logical reasoning, verbal ability and communication skills. But dueto the lack of proper training and internet access there arise some problem. After taking ICT class I am able to visualize the different mathematical objects, shape, problem and their relationships. Also I am able to proof the mathematical formulas using Geogebra and Mathematica. In aggregate all course and activities of ICT in mathematics education is Goodin average."*

The theoretical review of the research states that constructivist perspective emphasizes 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 participating in classroom. From the above respondents views the ICT course, learning activities of ICT, use of tools, internet access and evaluation system of ICT also focused in constructivism learning theory. So theory and student's views are interrelated.

After taking interview of these four students and theoretical review,the researcher concludes that the ICT course were well designed and the classroom facilities, materials and equipment's are also well managed. Practical evaluation process of ICT is also different.The teachers were also properly trained. The Geogebra and Mathematica software helps students to enhance their internal ability and also makes them easy and timely. Students get learning and sharing culture from the ICT

classes and teachers. So the students have positive attitude towards ICT in mathematics education.

Chapter v

Summary, Findings, Conclusion and Recommendations

After the analysis and interpretation of collected data and per the design of study. In this concluding chapter on attempt has been made to drive conclusion. This chapter represents the summary of the study with major findings and conclusion. Finally, the last section presents recommendations for the future study.

Summary of the Study

In this study, the researcher was selected a topic attitude of master level students towards ICT in mathematics education. Under this topic, the researcher was established

the objectives find the attitude of students towards ICT in mathematics education and compare the attitude of students towards ICT in mathematics education with respect to gender.

For the achievement of these objectives of the study, the researcher gathered data by mixed research design method on which questionnaire for quantitative part and interview for qualitative part. The researcher collected the data by the tool of questionnaire under the 'Likert' five attitude scale in survey design of quantitative method. The population of the study was considered as all the students of Tribhuvan University Kirtipur, Kathmandu. The sample was selected as random sampling from 100 students (85 boys and 15 girls) of ICT in mathematics education and four students using purposive sampling in interview.

Teacher attitudes towards ICT Scale developed by Mehera and Far (2013) was used and modified to measure the student's attitude towards ICT in mathematics education. A set of 50 questionnaires among them statements 4, 19,28,41,42,44 and 47 are negative and other are positive on the domains (use of curriculum, teaching learning activities, application of tools, use of internet and evaluation system of ICT) were developed as the tool for collection of data. To collect the data from interview the researcher used interview guideline. The reliability was based on pilot test. The questionnaire had five level of statements strongly agree, agree, undecided, disagree and strongly disagree of Likert scale. The obtained data were calculated using the Statistical Package for Social Sciences (SPSS) programmer, version 21.0 setting at 0.05. To analysis the data χ^2-test and percentage was used to determine the attitude of students towards ICT in mathematics education. And the t-test, mean score and standard deviation was used to determine the significance difference between the attitude of boys and girl's students.

In this study all the statements were analyzed by χ^2-test, t-test and percentage. Lastly, the researcher found that students had positive attitude towards ICT in mathematics education due to well managed course, classroom, computer lab, well trained teachers, software and teaching learning activities. All the statements were significant and there is significance difference between the attitude of boys and girl's students.

Findings of the Study

In the study, the researcher was selected University Campus Tribhuvan University Kirtipur, Kathmandu as a research field for the objectives of the study. To identify attitude of students and compare it with gender wise towards ICT in mathematics education Likert's five points scale, questionnaire was developed in different domains which are already mentioned above. When the data was collected and tabulated then analyzed by using ^{2}-test, percentage, t-test, mean attitude score and standard deviation. After statistical analysis using SPSS software of the collected data the researcher yielded the following results as findings of the study.

- The master level students had a positive attitude towards ICT in mathematics education.
- The t-value of the boys and girl's students is 6.31 Moreover; the mean score of boys and girl's students is 301.18 and 54.18 respectively.
- Less than 50% of students were agreed with the statements 25, 32, 34, 36, 43 and 46. It concludes that students have not positive attitude with these statements.
- The mean score of boy's (301.18)student's attitude towards ICT in mathematics education was found higher than girl's (54.18) students.

- Since calculated value of t- test 6.31 does not lies between tabulated values ±1.96. Therefore, there was significance difference between attitude of boys and girl's students with ICT in mathematics education.
- Due to Systematic classroom activities, well managed equipment and course, evaluation process students had positive attitude towards ICT in mathematics education.

Conclusions

The review of constructivist perspectiveemphasizes 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 participating in classroom.From the review of theory and finding of the research also focused that there was active participation of students in ICT classroom learning activities, use of ICT tools and evaluation system.

Moreover, the findings of this study states that master level students had positive attitude towards ICT in mathematics education. But there was significance difference between boys and girl's attitude towards ICT in mathematics education. Mean attitude score of boy's students is significantly different that of girl's students. Attitude of boy's students is better than attitude of girl's students towards ICT in mathematics education.

Recommendations

Since the present study was limited in master level Tribhuvan University Kirtipur, within the Kathmandu district, so finding of the study can be generalized for the same University. But it can't be generalized to all level and other universities. So, considering these limitations the following recommendations had been made.

- To establish the findings, similar study should be carried out other universities.
- ICT based teaching learning activities should be given priority in mathematics education.
- Internet facility is necessary and should be improve to learn ICT in mathematics education effectively.
- Policy-makers should provide additional planning time for students to experiment with new ICT-based approaches.
- There must be well designed course, sufficient materials and equipment's in ICT lab, internet access, trained teachers and evaluation system to be positive attitude.

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Appendix-A

ICT Attitude Questionnaire for Students

Dear friends

I am from the central department of mathematics education, TU, Kirtipur, to conduct a research on "Attitude of Master Level Students towards ICT in Mathematics Education." Which is for the practical fulfilment of requirement for the degree of masters in mathematics education. This questionnaire consists of 50 statements about ICT in mathematics education. Please read each statement then indicate your reaction to each of the following statements by ticking (√) appropriate choice for the statements represents your level of agreement or disagreement with it. Make sure to respond to every statement.

Researcher

AmbaDatt Joshi

ambajoshi24@gmail.com

Name: Level: College:

SN	Statements	SA	A	N	D	SD
ICT Curriculum						
1	I would like to take ICT courses.					
2	Often in class activities, we discuss pros of ICT into math curriculum.					
3	I am extremely happy with ICT injected math curriculum.					
4	Course contents of ICT are not sufficient to teach mathematics in secondary level.					
5	ICT course helps for reducing math-learning anxiety.					
6	ICT courses have been embedded math learning culture in outside of classroom.					
7	ICT in mathematics provided me greater chance for minimizing misconceptions allied to the subject matters.					

8	Technological devices in the ICT course are sufficient for be causation on application.					
9	I am happy with the software equipment in my ICT curriculum.					
Teaching Learning activity						
10	Use of ICT in the mathematics classroom would make the subject matter more interesting.					
11	ICT can increase collaboration (co-operation) between students.					
12	My confidence in mathematics is more increased by taking different software activities in mathematics learning.					
13	ICT gives opportunity to learn more in mathematics.					
14	After using ICT I feel it change the way students learning in mathematics classroom.					
15	Using ICT improves quality of problem solving strategy in mathematics.					
16	ICT helps me to select appropriate strategy for my own learning.					
17	Virtually manipulation nature of ICT enforces me to revise any contents.					
18	ICT is useful in mathematics learning owing to its simplicity for disseminating information.					
19	I think that the usage of ICT restricts the creativity of the students.					
20	Involving in technologically enhanced learning activities I can visualize mathematical objects.					
21	Learning with computers offers real advantages in terms of learning styles.					
22	We have administrative support for adopting ICT into learning processes.					
23	The more I experience ICT, the fewer problems I face in learning.					
Application of Tools						
24	ICT increase the motivation of students by taking it as an instructional tool.					
25	I have no difficulty in operating the basic functions of GeoGebra and Mathematica.					

26	I can use ICT tools like Web Camera, Printer and projector for my own learning.					
27	ICT tool makes learning easier.					
28	I am not happy with the software programs in my learning mathematics.					
29	I feel funny to operate mathematical function of computer.					
Use of Internet						
30	I use internet for my daily class work.					
31	Internet facilitates learning more attractive inside and outside of the class.					
32	Using internet prevents me from socializing.					
33	Internet isolates students by discouraging social interactions among their friends.					
34	Internet improves my learning satisfaction in mathematics.					
35	Internet develop learning through sharing culture in mathematics.					
36	The networking facility at my learning classroom is satisfactory.					
37	I am motivated with internet facility in learning mathematics.					
38	Using internet helps me to communicate mathematical information with my friends.					
Evaluation System						
39	ICT helps an individuals' self- evaluation.					
40	I am interested personally in developing my skills and knowledge in ICT as it is appropriate to my learning.					
41	I feel insecure about my utilization of software ability.					
42	Use of ICT in mathematics education reduces the personal treatment of students.					
43	Practical skills only measured by ICT based Evaluation.					
44	I am not satisfied with the administrative support on ICT in my classroom.					
45	I believe that ICT improve the quality of mathematics education.					
46	I feel my skills and knowledge in ICT are adequate for learning with ICT.					

47	I find using ICT is time consuming.					
48	Using ICT is often frustrating.					
49	ICT helps me to finish work at a time.					
50	ICT could increase my productivity in mathematics.					

Note: SA- Strongly Agree A- Agree N- Neutral

D- Disagree SD- Strongly Disagree

Appendix-B

Responses of Boys Students

S. N	Statements	SA	A	N	D	SD	T
1	I would like to take ICT courses.	55	28		2		391
2	Often in class activities, we discuss pros of ICT into math curriculum.	12	38	22	9	4	300
3	I am extremely happy with ICT injected math curriculum.	33	42	10	0	0	363
4	Course contents of ICT are not sufficient to teach mathematics in secondary level.	8	45	21	8	3	208
5	ICT course helps for reducing math-learning anxiety.	30	37	11	2	5	340
6	ICT courses have been embedded math learning culture in outside of classroom.	6	46	32	1	0	312
7	ICT in mathematics provided me greater chance for minimizing misconceptions allied to the subject matters.	8	55	20	2	0	324
8	Technological devices in the ICT course are sufficient for be causation on application.	5	38	38	3	1	298
9	I am happy with the software equipment in my ICT curriculum.	28	31	3	21	2	348
10	Use of ICT in the mathematics classroom would make the subject matter more interesting.	30	41	12	2	0	354
11	ICT can increase collaboration (co-operation) between students.	13	56	9	3	4	326
12	My confidence in mathematics is more increased by taking different software activities in mathematics learning.	11	53	21	0	0	330
13	ICT gives opportunity to learn more in mathematics.	31	42	11	1	0	358
14	After using ICT I feel it change the way students learning in mathematics classroom.	8	45	29	2	1	312
15	Using ICT improves quality of problem solving strategy	2	38	37	4	4	285

	in mathematics.						
16	ICT helps me to select appropriate strategy for my own. learning.	12	46	14	6	7	305
17	Virtually manipulation nature of ICT enforces me to revise any contents.	11	47	19	4	4	312
18	ICT is useful in mathematics learning owing to its simplicity for disseminating information.	8	40	26	10	1	299
19	I think that the usage of ICT restricts the creativity of the students.	4	15	4	43	19	313
20	Involving in technologically enhanced learning activities I can visualize mathematical objects.	15	35	30	3	2	313
21	Learning with computers offers real advantages in terms of learning styles.	18	32	29	6	0	317
22	We have administrative support for adopting ICT into learning processes.	16	42	9	14	4	307
23	The more I experience ICT, the fewer problems I face in learning.	55	19	5	4	2	376
24	ICT increase the motivation of students by taking it as an instructional tool.	21	48	13	2	1	341
25	I have no difficulty in operating the basic functions of GeoGebra and Mathematica.	6	20	9	34	16	221
26	I can use ICT tools like Web Camera, Printer and projector for my own learning.	8	35	6	33	3	267
27	ICT tool makes learning easier.	62	16	6	2	0	396
28	I am not happy with the software programs in my learning mathematics.	5	49		21	10	264
29	I feel funny to operate mathematical function of computer.	20	46	14	4	1	335
30	I use internet for my daily class work.	12	33	22	11	7	287
31	Internet facilitates learning more attractive inside and outside of the class.	13	53	15	1	3	328
32	Using internet prevents me from socializing.	6	30	4	43	2	250

33	Internet isolates students by discouraging social interactions among their friends.	5	44	24	4	8	289
34	Internet improves my learning satisfaction in mathematics.	1	27	7	44	6	228
35	Internet develop learning through sharing culture in mathematics.	5	64	11	5	0	324
36	The networking facility at my learning classroom is satisfactory.	2	13	5	59	6	201
37	I am motivated with internet facility in learning mathematics.	6	44	17	12	6	287
38	Using internet helps me to communicate mathematical information with my friends.	12	65	6	2	0	342
39	ICT helps an individuals' self- evaluation.	6	49	20	9	1	305
40	I am interested personally in developing my skills and knowledge in ICT as it is appropriate to my learning.	1	39	31	14	0	282
41	I feel insecure about my utilization of software ability.	1	62	9	4	9	213
42	Use of ICT in mathematics education reduces the personal treatment of students.	4	45	11	24	1	228
43	Practical skills only measured by ICT based Evaluation.	3	17	14	49	2	225
44	I am not satisfied with the administrative support on ICT in my classroom.	2	32	4	47	0	266
45	I believe that ICT improve the quality of mathematics education.	8	55	12	7	3	313
46	I feel my skills and knowledge in ICT are adequate for learning with ICT.	3	17	12	49	4	221
47	I find using ICT is time consuming.	2	11	10	56	6	308
48	Using ICT is often frustrating.	2	48	13	19	3	282
49	ICT helps me to finish work at a time.	7	51	15	11	1	307
50	ICT could increase my productivity in mathematics.	5	41	15	23	1	302

Appendix-C

Responses of Girls Students

S	Statements	SA	A	N	D	SD	T
1	I would like to take ICT courses.	9	5	1	0	0	68
2	Often in class activities, we discuss pros of ICT into math curriculum.	4	8	3	0	0	61
3	I am extremely happy with ICT injected math curriculum.	6	4	3	2	0	59
4	Course contents of ICT are not sufficient to teach mathematics in secondary level.	1	6	3	4	1	43
5	ICT course helps for reducing math-learning anxiety.	3	6	2	4	0	53
6	ICT courses have been embedded math learning culture in outside of classroom.	2	7	5	1	0	55
7	ICT in mathematics provided me greater chance for minimizing misconceptions allied to the subject matters.	3	10	2	0	0	61
8	Technological devices in the ICT course are sufficient for be causation on application.	0	5	7	3	0	46
9	I am happy with the software equipment in my ICT curriculum.	6	8	1	0	0	65
10	Use of ICT in the mathematics classroom would make the subject matter more interesting.	8	6	1	0	0	67
11	ICT can increase collaboration (co-operation) between students.	2	9	4	0	0	58
12	My confidence in mathematics is more increased by taking different software activities in mathematics learning.	3	5	5	2	0	54
13	ICT gives opportunity to learn more in mathematics.	4	4	5	2	0	55
14	After using ICT I feel it change the way students	2	8	5	0	0	57

	learning in mathematics classroom.						
15	Using ICT improves quality of problem solving strategy in mathematics.	3	7	4	1	0	57
16	ICT helps me to select appropriate strategy for my own. learning.	3	5	6	0	1	54
17	Virtually manipulation nature of ICT enforces me to revise any contents.	2	9	2	2	0	56
18	ICT is useful in mathematics learning owing to its simplicity for disseminating information.	2	4	8	1	0	52
19	I think that the usage of ICT restricts the creativity of the students.		2	3	3	7	60
20	Involving in technologically enhanced learning activities I can visualize mathematical objects.	2	8	4		1	55
21	Learning with computers offers real advantages in terms of learning styles.	5	6	3	1	0	61
22	We have administrative support for adopting ICT into learning processes.	5	5	3	1	1	57
23	The more I experience ICT, the fewer problems I face in learning.	10	3	2		0	68
24	ICT increase the motivation of students by taking it as an instructional tool.	7	4	3	1	0	62
25	I have no difficulty in operating the basic functions of GeoGebra and Mathematica.	1	2	2	7	3	36
26	I can use ICT tools like Web Camera, Printer and projector for my own learning.	2	8	4	1	0	56
27	ICT tool makes learning easier.	9	3	2		0	63
28	I am not happy with the software programs in my learning mathematics.		5	4	4	2	48
29	I feel funny to operate mathematical function of computer.	5	7	3	0	0	62
30	I use internet for my daily class work.	5	8	2	0	0	63
31	Internet facilitates learning more attractive inside and outside of the class.	1	5	6	2	1	48

32	Using internet prevents me from socializing.	0	1	4	9	1	35
33	Internet isolates students by discouraging social interactions among their friends.	1	7	7	0	0	54
34	Internet improves my learning satisfaction in mathematics.	2	8	4	1	0	56
35	Internet develop learning through sharing culture in mathematics.	3	7	5	0	0	58
36	The networking facility at my learning classroom is satisfactory.	0	0	3	8	4	29
37	I am motivated with internet facility in learning mathematics.	1	9	5	0	0	56
38	Using internet helps me to communicate mathematical information with my friends.	1	9	3	2	0	54
39	ICT helps an individuals' self- evaluation.	2	7	4	2	0	54
40	I am interested personally in developing my skills and knowledge in ICT as it is appropriate to my learning.	2	8	4	1	0	56
41	I feel insecure about my utilization of software ability.	0	3	2	8	2	54
42	Use of ICT in mathematics education reduces the personal treatment of students.	1	9	3	2	0	36
43	Practical skills only measured by ICT based Evaluation.	2	2	5	5	1	44
44	I am not satisfied with the administrative support on ICT in my classroom.	1	3	1	6	4	54
45	I believe that ICT improve the quality of mathematics education.	2	9	3	1	0	57
46	I feel my skills and knowledge in ICT are adequate for learning with ICT.	2	7	2	3	0	50
47	I find using ICT is time consuming.	0	4	2	5	4	54
48	Using ICT is often frustrating.	0	2	3	6	4	33
49	ICT helps me to finish work at a time.	2	9	3	1	0	57

50	ICT could increase my productivity in mathematics.	2	10	2	1	0	58

Appendix D

ICT Attitude: Interview Guideline

1. Are you sure the course content of ICT in mathematics education increase more knowledge and skills of mathematics?
2. Have you developed logical reasoning power and creativity in mathematics by taking this course?
3. Are you satisfied with the application of mathematical software to achieve the required objectives of mathematics education?
4. Were there adequate ICT materials and well management in ICT lab?
5. Have you found and develop different evaluation techniques in ICT?
6. What do you think, can students develop the practical skills in mathematics after taking ICT course?
7. Are there effective learning activities in ICT classroom?
8. Have you got learning through sharing culture in mathematics education after taking ICT class?
9. After taking this course are you habitual to visualize mathematics problem?
10. As a whole are you agree ICT develop learning ability of students?