PERCEPTION TOWARDS THE USE OF ICT IN MATHEMATICS TEACHING AND LEARNING

A

THESIS

BY

ROHIT GHIMIRE

IN THE PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTERS OF EDUCATION

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Letter of Certificate

This is to certify that Mr. Rohit Ghimire, a student of the academic year 2074/75 BS with Thesis Number 1758, Exam Roll 7328434, Campus Roll 103, T.U. Regd. No. 9-2-233-218-2009 has completed his thesis during the time prescribed by the rules and regulations of T.U. Nepal. This thesis entitled "**Perception Towards the Use of ICT in Mathematics Teaching and Learning"** embodies the result of investigation conducted during the period of December 2019 to April 2022 at the department of Mathematics Education, University Campus, Tribhuvan University, Kirtipur, Kathmandu. I hereby recommend and forward that his thesis be submitted for the evaluation for the evaluation to award the Degree of Master of Education.

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Letter of Approval

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Thesis

By

Rohit Ghimire

Entitled

"Perception Towards the Use of ICT in Mathematics Teaching and Learning"

has been approved in partial fulfillment of the requirement for the Master Degree of Education.

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Recommendation for Acceptance

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Declaration

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

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Rohit Ghimire

Dedication

Honestly dedicated

To

My parents

Acknowledgements

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…….

Rohit Ghimire

Abstract

The present study **"Perception towards the use of ICT in mathematics teaching and learning"** is carry out to uncover the praxis of using ICT in mathematics teaching and learning and to explore the perception of teachers and students towards the practices of ICT in mathematics teaching and learning.

The study adopted descriptive survey design and the information/data was collected by observation checklist, questionnaire and FGD. An observation checklist for 20 schools' teachers and students, two sets of questionnaires are prepared where one set for 200 students and another for 100 mathematics teachers from Kathmandu valley, Sindhuli and Mahottari districts. The collected data were organized, tabulated, analyzed and interpreted by using the statistical tools such as percentage and χ^2-test at 0.05 level of significance. FGD among four groups of teachers each group including 8 members and the collected information were categorized descriptively by transcribing, translating and connecting with related theory.

The result of the study showed that the schools have sufficient ICT tools with suitable existing situation for teaching and learning Mathematics. Both the teachers and students have positive perception towards the use of ICT in mathematics teaching and learning. More than 80% teachers and all the students agreed that the ICT tools are very useful for higher achievement as well as higher study by providing basic concept with motivation.

Table of Contents

Page No.

Chapter I

Introduction

Background of Study

ICT, it is defined as an innovative method of delivering learning through the internet at flexible times and places, which differs from traditional face-to-face study methods. Normally, ICT includes most types of electronic learning and teaching (Govindasamy, 2002). Learning through ICT is commonly refered to as web-based learning, internet-based learning and computer-based learning (Kahn, 2001).

As ICT has been widely used since the 20th century, other terms such as 'online learning', 'virtual learning', 'e-learning' have also sprung up in search of an accurate description. The potential of each technology varies according to how it is used. Haddad and Draxler (2002) identified at least five levels of technology use in education; presentation, demonstration, drill and practice, interaction and collaboration (en.wikibooks.org). ICT in education has, however, been documented throughout history, and there is evidence to suggest that early forms of the technology existed well before the 20th century.

Long before the internet was launched, distance courses were being offered to provide students with education on particular subject or skills. In the 1840's Issac Pitman taught his pupils shorthand via correspondence. This form of symbolic writing was designed to improve writing speed and was popular amongst secretaries, journalist and other individuals who did a great deal of note taking or writing pitman, who was a qualified teacher, was sent completed assignment by mail and he would then send his students more work to be finished using the same system.

In 1924, the first testing machine was invented. This device allowed students to tests themselves. Harvard professor BF Skinner invented the "teaching machine" in

1954, which enabled schools to teach their students using preprogrammed instructions. Although computer-based training programs were introduced to the world in 1960, they weren't widely used until then. The computer-based training program was called PLATO-programmed logic for automated teaching. Although it was initially created for University of Illinois students, it is now used in many local schools.

With the introduction of computer and internet in late 20th century, ICT tools, e-learning tools and delivery methods expanded. People were able to have computers in their homes because to the invention of the first MAC in the 1980s, which made it simpler for people to study about specific subjects and hone particular skill sets. Then, in the decade that followed, the virtual learning environment started to develop and people had access to a wealth of online knowledge.

The MOE has put in place a few ICT-related educational programs. For math students in schools, some NGOs have created interactive digital learning resources. In accordance with the matching grant programs (from 2007 to 2010), DOE gave 3038 schools tow computers and one printer (DOE, 1010). Each of the 62 schools was given a computer and a printer as part of the Education for all program's formative research project between 2004 to 2009. Along with providing computers and other accessories to some schools and basic computer training to teachers, some NGO's, trusts and individuals also supported ICT-related infrastructure and internet connectivity for 785 schools during the fiscal years 2010 and 2011 (ICT in Education Master Plan, 2013). Additionally, DOE gave 85 secondary schools internet access so they could run a distance learning program at the secondary level (DOE, 2012). To improve educational management and delivery system, the ministry of education has provided some additional ICT related equipment to all district education offices and

launched website in each district education office. In June, 2012, the MOE had endorsed a guideline for the implementation of ICT in school in Nepal.

Shrestha (2018) discussed about the recent provision of government of Nepal in the field of using ICT in education as:

> *"The use of information and communications technology (ICT) in education in Nepal is currently a hotly debated subject. Utilizing ICT in education is one of the strategies included in the ICT Master Plan (2013-2017) for achieving the larger objectives of education. The most recent School Sector Development Plan (SSDP) 2016-23 seeks to leverage ICT as a cruicial instrument to better school governance and management, increase access to teaching and learning resources, and improve classroom delivery. But the question is how far we are implementing ICT for teaching and learning, and how much support we have received to implement ICT in education…"* (Shrestha, 2018)

ICT in education includes all learning (either formal or informal) carried through electronic delivery. More precisely, ICT in education includes computer-based learning, which includes elements of online learning, as well as internet-based learning.

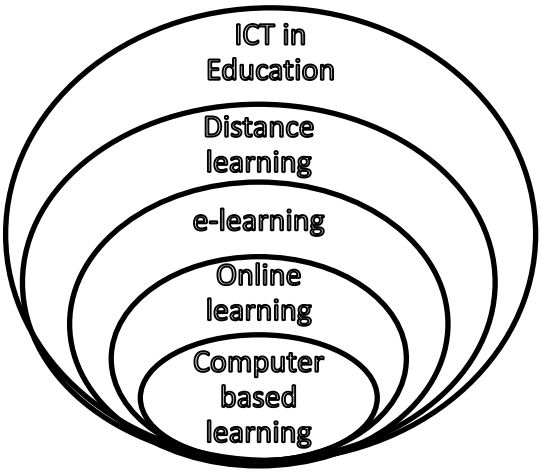

Figure 1 [Source: Scope of e-learning (Bachman, 2002)]

In industrialized nations, the use of web-based educational resources, multimedia, CD-ROMs, e-mail, educational animation, etc., has been and continues to be widespread for educational purposes. However, a developing nation like Nepal is still getting used to the idea. Although the use of ICT in education has recently gained popularity in Nepalese cities, the country's educational system still mostly focuses on the conventional method of teaching and learning.

Problem Statement

Perception is pivotal in giving a sound interpretation. In this perspective, people use their perception in order to understand the world around them such as how the teachers' activities, teaching methods and teaching materials control the classroom and attract student's attention towards subject matter. Perception is also known to help in the molding of a person's character and attitude. Understanding the perception of teachers, a clear direction can be given as to how ICT can be used effectively in mathematics education. In essence, perception is such an important aspect of a people's life that hone and use perception to their advantage cannot only mold them but also create their future. Therefore, it is necessary to study and research about the perception of teachers and students to sharpen the students' abilities, teachers' caliber and to establish the ICT as vital tool in teaching mathematics in future.

There is no such study carried out on the attitude of the students over ICT in Mathematics at secondary level in the context of Nepal. So, the purpose of this study is to find out opinion of students and teachers about using ICT in mathematics. This study provides systematic and empirical data on perspective of students and teachers on using ICT in mathematics teaching and learning, even if it was limited to the boundary of secondary level administration, students as well as Mathematics teachers.

The MOE has access to several ICT-related policies and programs at the school level. Three-year plan2011-2013, SSRP (2009-2015), and IT policy (2010), The Nepalese government has established various regulations and integrated ICT into the educational system (MOE, 2013 and NCF, 2005). Such as;

- Internet connectivity should be made more widely available to all schools, and there should be coordination and collaboration with national and international organizations to provide qualified human resources for ongoing, relevant, and high-quality education.
- In order to create competent human resources, industry-academic collaboration (IAS) should be promoted. Additionally, a unique IT program should be developed and implemented with a focus on students, teachers and schools.

Objectives of the Study

- To uncover the praxis of using ICT in mathematics teaching and learning.
- To explore the perception of teachers and students towards the practices of ICT in mathematics teaching and learning.

Research Questions for the Study

The problems of the study are concerned with the existing situation for practices of ICT in mathematics. It also included the attitude of secondary level students and teachers towards ICT. Therefore, the research questions for the study are:

1. What are the present status for practice of ICT in mathematics in school?
2. How teacher and students perceived on the use of ICT in mathematics teaching and learning activities?

Justification of the Study

The internet has become one of the vital ways to make available resources for research and learning for both teacher and students to share and acquire information (Richard & Haya, 2009).Technology based learning encompasses the use of the internet and other important technologies to produce materials for learning, teach learners and also regulate courses in an organization (Fry, 2001). The Ministry of Education aims at providing necessary skills on Information and Communication Technology to the students as well as using ICT as an important tool to improve classroom delivery, increase access to learning materials and improve effectiveness and efficiency of overall educational governance and management (MOE, 2013).

This study had the following significance:

- The research investigated the beliefs felling and perception of Mathematics teachers and students towards ICT.
- It contributes to find the way to decrease the failure rate of the students in mathematics at secondary level.
- It helped to guide the instruction on the basis of individual difference.
- It helped to decrease the student's dependency to their teacher to solve the Mathematical problems.
- It introduced additional pedagogy in existing educational system.
- It helped the councilor to provide positive attitude of ICT.
- It will assist school administrators and policy makers in deciding on the best ways to handle changes brought on by the usage of ICT in the educational system.

Delimitations of the Study

This study had following limitations:

- The study was based on opinion of secondary level students and mathematics teachers.
- The study was limited in the public and private secondary schools in Kathmandu valley, Dhanusha and Sindhuli.
- I explored the problem of teaching and learning on the basis of observation checklist, questionnaire and FGD.

Definition of the Operational Words

E-Learning. E-learning is a computer based educational tool or system that enables students to learn anywhere and at any time. It is one way or two ways learning using the different tools such as computer, laptop, mathematical software, video, book, internet and television.

Information and communication Technology (ICT). ICT in this context refers to the use of hardware and software to create and distribute educational resources for students.

1. Hardware: Sharing devices (pen drive, smart phone), video input (laptop) and video output (monitor or screen).
2. Software: It once produced and distributed educational materials using mathematical software.

Practice of ICT in classroom. Classroom practice includes the relationship, interaction and communication between teacher and students for teaching and learning process.

Pedagogy. Pedagogy, in which teacher first gives the basic idea or concept on some topic of mathematics and teacher solves some problems related to that concept as

example in classroom and remaining problems to that topic are given to the students as classwork and homework.

Situation of ICT. Situation of ICT means readiness of teacher/tutor, and learners towards ICT, school administration by materials, attitude as well as access of ICT.

Asynchronous. Refers to any type of communication where interactions take place at separate times and usually from different places. It is the predominate mode of communication used in email, learning managements (eg. Moodle) bulletins boards, website and text messages.

Synchronous. Any types of communication where interaction between participants occurs simultaneously. Examples relevant to this research include face-to-face conversations and telephone calls.

Chapter II

Review of Literature

The review of literature involves the systematic identification and analysis of documents related to the study under taken review of the previous studies helps to conduct the new research in systematic manner by providing the general outline of the research study and avoids the unnecessary duplications. Realizing the importance of the literary review some efforts are mode here to present the significant results or conclusions of different studies mainly focusing to the perspective towards ICT in mathematics with these assumptions.

Empirical Literature

Mulenga and Phiri (2018) studied on "Zambian Teachers' Profiles of ICT Use in Mathematics Pedagogy" with the purpose of identifying Zambian Teachers' profiles of ICT use in Mathematics Pedagogy. They followed person centered approach and apply descriptive statistics to narrower the knowledge gap by analyzing teachers' ICT skills, beliefs and attitudes towards the use of ICT in the teaching and learning of mathematics. The study performed Analysis of variance (ANOVA) over the data provided by ninety-two (92) teachers of Kabwe district by completing validated survey questionnaires to find mean differences between the perceived knowledge in teachers' ICT Math profiles and gender. The analyses revealed that teachers in Kabwe district possess ICT skills and showed positive attitudes towards ICT integration in mathematics classrooms.

Yadav (2016) conducted the research "Opinion towards the practices of e-learning in Mathematics" with the purpose of finding the Existing situation and opinion of students and teachers towards e-learning in relation to improve student's Mathematics achievement and analyze/explain the effect of ICT in motivating

students to learn Mathematics. The study was descriptive survey and data was collected by checklist, questionnaire and FGD. The study's findings indicates that schools had enough ICT resources and a favorable environment for teaching and learning mathematics. The practices of e-learning in mathematics are well received by both teachers and students.

Sapkota (2015) did research on "effectiveness of information communication technology integrated pedagogy at secondary level" with the aim to find the effectiveness of ICT integrated pedagogy in the existing educational system among students in the experimental and control group of grades IX. 46 students of two public secondary schools of Kathmandu district were selected for the study. She concluded that ICTIP bring the effective result in terms of the achievement of mathematics in comparison to the existing pedagogy as well as students taught by ICTIP are more motivated towards mathematics instruction.

Njagi (2014) did descriptive research on the topic "Teacher's perspective towards Differentiated Instruction Approach in Teaching and learning of mathematics in Kenya" with the main objective to investigate the teacher's perspective towards differentiated instruction in teaching and learning of Mathematics in secondary school in Kenya. The researcher finding in line with objective that guided the study total of 20 teachers responded to the questionnaire form and researcher found out that 70% of younger people preferred using differentiated instruction always in all the lessons they teach. The researcher found out that teachers have positive predisposition about differentiated instruction and that teachers have positive predisposition about differentiated instruction and that there is need for extensive training and support so that differentiated instruction can succeed.

Marian (2014) had published an article entitled “Learning Algebra and Geometry through ICT” highlighting different kinds of experiences for learning mathematics from those found in textbooks and traditional teaching in the classroom, for primary and secondary pupils. The article inspects ho features of ICT can be used to help create mathematical meaning for pupils, inside and outside the classroom in the areas of algebra and geometry for secondary pupils. Teachers need to be mindful of potential pitfalls and be ready to think about when the use of ICT is sensible. The article outlined some advice about how teachers can use ICT to their advantage and for the pupils’ enjoyment and learning.

Nkhwalume (2013) did exploratory action research “The challenges of integrating ICTs into the mathematics curricula in the SADC region: The case of Botswana to” to find out how the mathematics teachers were coping when using computers to teach mathematical concepts. This would make it possible to identify the challenges that the teachers faced both at school and classroom level. The researcher had collected the data during the Teaching Practice (TP) assessment period from May 2011 to July 2011. Also, a semi structured interview schedule was used to solicit information on how the researcher’s former students were incorporating computers in class room practice and the challenges they encountered. A total of 30 mathematics teachers were interviewed from three regions of Botswana. The researcher admits the view that technology has permeated our educational experiences and as educators seek viable ways to use technology to enhance teaching and learning experiences, colleges must also prepare future teachers to plan for effective technology use (Wright, Wilson, Gordon, & Stallworth, 2002). Researcher believed that teachers are more likely to integrate computers and the internet into classroom instruction if they

have access to adequate equipment, connections, and the proper amount of preparation and training (NCES, 2000).

Kalinga (2010) did descriptive research on "Development of an interactive e-learning management system for Tanzanian secondary schools" with the main objective to develop an interactive e-learning management system to be used by Tanzanian secondary schools' support teaching and learning functions. He concluded that when application of ICT in learning mathematics that is accessible even in remote and rural secondary schools will improve the performance of students in such secondary schools as well as raising morale for teachers and students.

Moila (2006) did research on the "The use of Educational Technology in Mathematics Teaching and learning: An investigation of South African Rural secondary school". The investigation used a mixed technique approach and was a case study with a stronger evaluation component. 25 students from Phacelia Secondary School and 5 math teachers participated in the study. According to the research, computer technology was not used in the teaching or learning of mathematics, there were no plans to use educational technology tools in these areas, educators had insufficient training in these areas, and there were few appropriate educational technology resources available to rural schools.

Clark (2005) aimed to identify the effect of ICT use in teaching geometry for academically talented students at high intermediate stage. 50 pupils in the ninth and tenth grades made up the study sample. The sample was split into two groups: the experimental group, which consisted of 25 students in the ninth grade enrolled in the Hispanic School and who studied geometry using ICT, and the control group, which consisted of 25 students in the tenth grade enrolled in the Florida School and who studied geometry using traditional methods with respect to instruments. Teachers'

observations and the Florida Test of competency Achievement were used. The Florida test was administered to both groups both before and after the same lessons were taught. The average results were then compared in order to assess the students' growth. The results of data collection and analysis showed that there were statistically significant variations in student accomplishment between the experimental and control groups, with the experimental group outperforming the control group. This study exhibits both glaring strengths and alarming weaknesses, similar to the majority of other ICT studies pertaining to mathematics. The study's capacity to pinpoint mathematical gains that pupils might make with ICT-based technology is its most significant contribution. The study's main flaw, in contrast, is that it limits its objectives to success and heavily relies on the usage of standard ICT technologies.

Recognizing the usefulness of ICT-assisted teaching for Mathematics in algebra and geometry themes (Invest Learning Programs) for pupils in rural public schools was a concern for Rendell (2001). The study sample included 120 students divided into two groups the experiment group and the control group. Over the course of three semesters, the 80 students in the control group studied conventionally, whereas the 40 students in the experimental group utilized ICT to aid in their studies. According to the study, ICT-assisted education was superior to conventional techniques for improving math students' arithmetical and logical skills.

Theoretical Perspectives

With the advance of information and communication technology (ICT), people's everyday life, including education as its integral part, has been in a process of dramatic change. Numerous studies have indicated that ICT can improve education outcomes (Barak, Watted, & Haick, 2016). The impact of ICT on education can be manifested by the changes related to the teaching form, teaching environment,

teaching content and teacher-student interaction, which greatly facilitate teaching and learning. Consequently, government and educational authorities from all over the world have invested a large amount of money into educational settings in the form of ICT aiming to transform traditional teaching (Wang & Dostal, 2017). However, we have found out that in many schools and universities, classroom teaching is still dominated by traditional education characterized by textbooks, blackboards, chalk, and talk, as most mathematics teachers still do not use computer technologies in classroom teaching (Dostal, 2017).

Perspective of teachers towards learning through ICT depends on their attitude and attitude is a mental and neural state of readiness, organized through experience, exerting a directive or dynamic influence upon the individual's response to all objective or dynamic influence upon the individual's response to all objects and situations with which it is related (Allport, 1935). The teacher is the direct implementer of ICT who must play an important role in combining ICT and mathematical content. Many studies have indicated that mathematics teachers' attitude plays a significant role in the successful integration of ICT into mathematics teaching and learning. Technology availability is in most cases mistaken for technology adoption and use (Albirine, 2006). Teachers are the most important agents of change within the classroom area and the successful implementation of educational technologies depends largely on the attitudes of educators (Albirine, 2006). So, teachers' belief or attitude can interfere with teachers' technology integration even when computer software and hardware is available (Ertmer, 1999).

ICT carried rollers of industry transformations, which is also visible in education industry. With the varying environment and the trade demand, student's perspective towards learning mathematics through ICT is also changing at a fast pace.

Gone are the days when teachers used to merely teach through blackboards in a lecture hall. The scenario is on the way of being invisible these days. ICT in mathematics education is being used to enhance creativity, interaction and knowledge sharing apart from student learning (Phutela & Dwivedi, 2019). But the query is whether ICT learning atmosphere is able to reach these ideas? Despite the effort of every concern institute of developing positive perception towards using ICT in mathematics learning, students are still not fully convinced with the potential benefits of it (Phutela & Dwivedi, 2019).

The theoretical perspective of this study was the constructivist theory of learning. The constructivist theory has chosen because it builds on prior knowledge: students use what they already know to make connections to new method of ICT assisted instruction. When students make connections, they learn new technology and relate it to what they already know. In this study ICT assisted instruction has based on constructivist theory of learning, because knowledge is actively constructed by the students while they are making constructions and analyzing figures instead of knowledge being passively received and accepted. Many educators today believe that the constructivist theory is a relatively new theory in education although the tenets of constructivism can be traced back to Socrates.

These theoretical concepts gave me a lot of ideas about the use of ICT in education. Theoretical review helped me understand about the ICT and its implementation in education. It is significant to use ICT in education. Thus, I tried to find out the existing situation of ICT in our context, I also tried to find out the perception of students and teachers towards use of ICT in mathematics teaching and learning.

Conceptual Framework

Student's satisfaction with ICT environment was examined in several studies. Positive learning climate and performance expectations affect student's satisfaction, and performance expectation provide the greatest contribution to learning satisfaction users (students and instructors) will hold positive attitudes towards ICT in mathematics if they recognize that it would help them improve their learning and teaching effectiveness and efficiency (Yadav, 2016). Understanding student's attitude can help expand learning system using ICT and meet student's needs, which should further increase the impact of learning and enhance satisfaction with the learning process (Chen & Wu, 2012). The vast majority of students who were satisfied with use of ICT in Mathematics held positive believes and attitude towards it.

From the above discussed standpoint in related literature, perception towards ICT in mathematics may depend upon different variable. These variables are expectations of teachers as well as students and satisfaction of teachers as well as students. The modified framework (Mayer, 2004) of such variables is presented here.

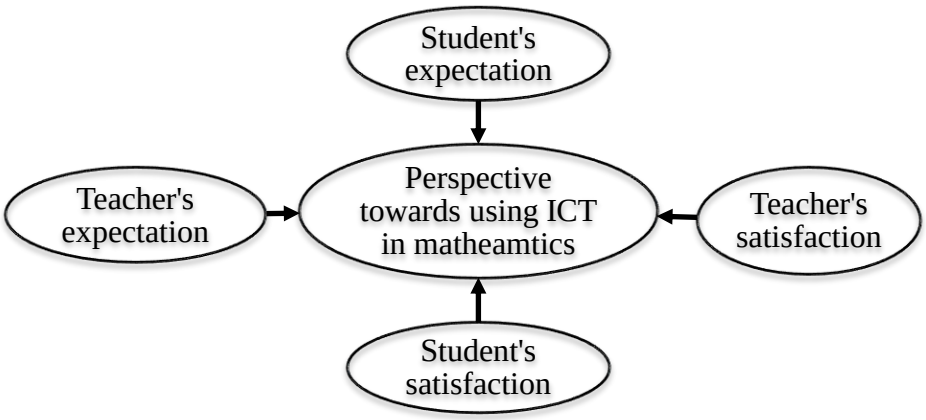

Figure-2 *Mayer's framework, 2014*

Also, the factors affecting teachers and students' perception towards use of ICT in mathematics teaching and learning can be divided into two groups: extrinsic

factors also called controllable factors and intrinsic factors also known as uncontrollable factors (Wang & Dostal, 2017). The following diagram explains briefly about such factors.

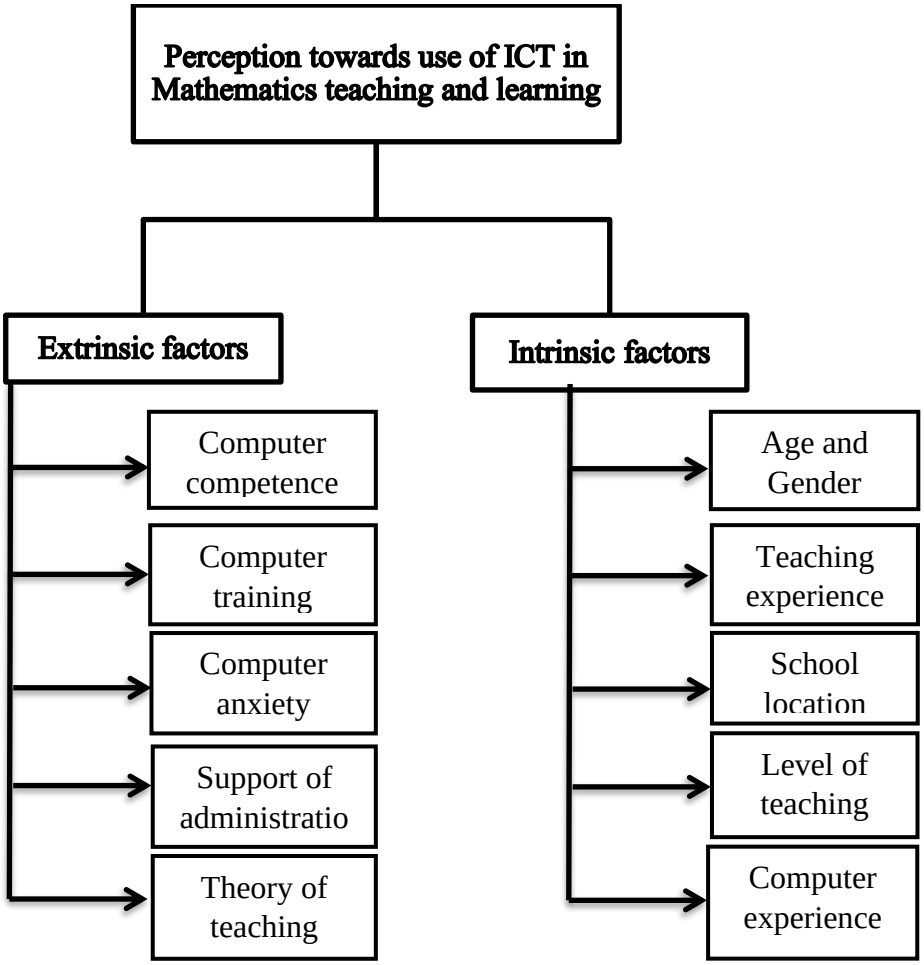

Figure-3 *Controllable and uncontrollable factors*

Chapter III

Methods and Procedures

This chapter explains how the study was carried out to attain its goals and discusses the method used for the qualitative research that was done to find a solution to the issue. Since it covers the following subjects, this chapter provides the clear and specific guidance needed to respond to queries and accomplish goals:

- Research design of study
- Population and sample of study
- Tools of study
- Validation of tools
- Data collection procedure
- Data Analysis and interpretation procedure

Research Design of the Study

Research methods that focus on current conditions, behaviors, attitudes, process, relationships, or trends are generally referred to as descriptive survey studies. For the purpose of describing and interpreting current conditions or situations, descriptive research focuses on acquiring data (Agrawal, 2018). This form of research methodology includes accurate analysis, interpretation, comparisons, and the identification of trends and linkages in addition to just gathering and tabulating facts. Last but not least, descriptive research explains the current state of people, attitudes, and advancement. The study's design is a descriptive survey because my search is focused on opinions regarding the usage of ICT in mathematics teaching and learning.

Population and Sample of the Study

The population of the study consisted of all the secondary level students and mathematics teachers of public and private school of Kathmandu Valley, Mahottari

and Sindhuli districts on the academic year 2079. This study was conducted within Kathmandu Valley, Mahottari and Sindhuli districts. In order to fulfill the objectives of the study, I took 20 schools by convenient sampling to represent the total population. The sample of the study was 200 students and 100 teachers of mentioned districts and, 10 students and 5 teachers were taken randomly from each school. Observation checklist and questionnaire were used for the sample of teachers and students and focus group discussion was used to grasp the teachers' intuitive understanding and insight.

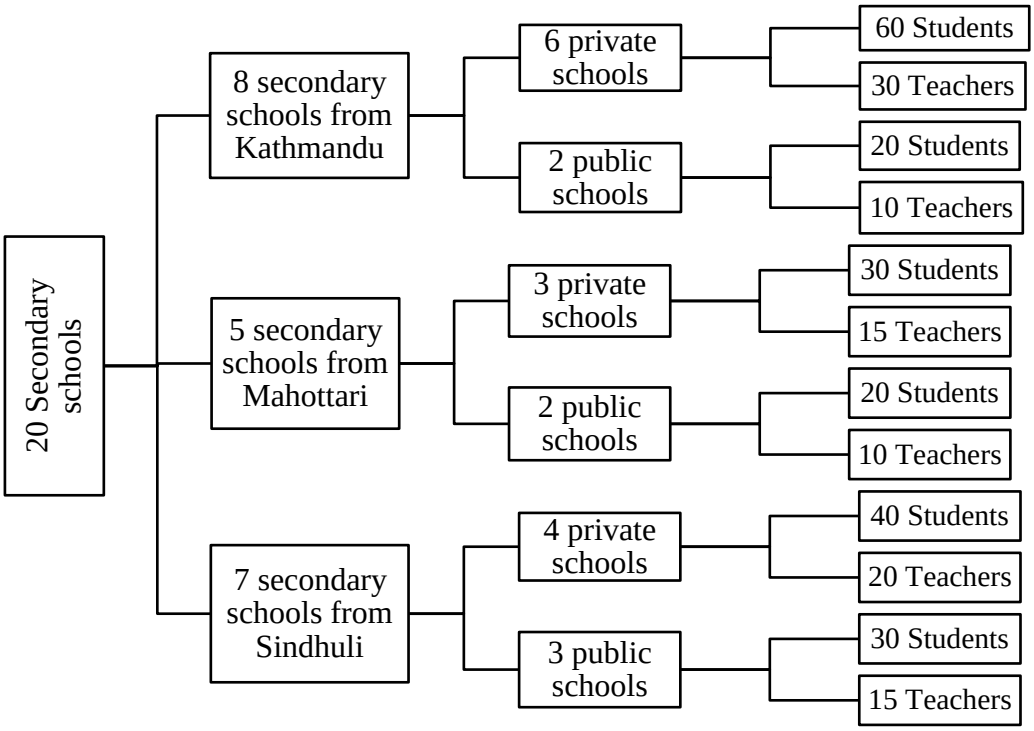

Figure 4: Sample of Schools, Teachers and Students

Tools of the Study

To collect the valid data three types of tools were adopted. To fulfill the first objective I used checklist, and for the second objective, questionnaire and focus group discussion were used.

Observation checklist. The observation checklist was for the people that have a role in making decisions or providing recommendations on the purchase or development of ICT to support ICT use in mathematics. It served as a handily guide to the key steps and sign-offs needed for must learning through ICT. It helped to find out the existing situation, environment for learning through ICT and to find out the ICT related material available in schools (Moila, 2006). Here, observation checklist is used by the researcher to evaluate the performance, behavior and attitude of teachers and students towards the use of ICT in mathematics teaching and learning activities.

Questionnaire. A questionnaire is major tools for data collection in the study. The questionnaire was considered on the basis of the use of ICT relating curriculum, teaching methods, classroom management, student background, teacher training and personal problems (i.e., time management, speaking style, body language, knowledge of subject matters), of the teacher. The detailed of the questionnaire was prepared and presented. The questionnaire consists personal bio-data such as name, age, gender, academic qualification, school name, trained or untrained and length of teaching experience of secondary mathematics teacher.

Two form of questionnaire was developed. One was given to learners; to understand the existing situation about the ICT integration in mathematics classroom and to find out their interest towards the use of ICT. And the other one to the teachers; to know their understanding, abilities and caliber on how to use ICT in mathematics classroom. They were prepared in the turn of structured guide line of articles, published and unpublished thesis “The use of Educational technology in Mathematics teaching and learning” (Moila, 2006)

Focus Group Discussion (FGD)

Unlike, the observation checklist and questionnaire, the FGD stimulates a discussion and use it's dynamics of developing conversation in the discussion as the central source of knowledge (Katrina Roen PhD, 2007). Participants tend to provide checks and balance on each other which weeds out false or extreme views. The extent to which there is a relatively consistent, shared view can be quickly assessed (Patton, 1990). The FGD is a rapid assessment, semi-structured data gathering method in which a purposively selected set of participants gather to discuss and concerns based on a list of key themes drawn up by the researcher. To make discussion effective, participants should be kept on round table. One hour discussion among participants will be done. The group will be homogeneous but ideas, feelings, thoughts, perceptions and tendency of participants will be involved in focus group involving 8-10 participants. Similarly, if in a group more than 12 participants are involved, then the group cannot be well managed and become fragmented (Cohen, Manion, & Morrison, 2000). Beside this, it is not sufficient to discuss in only one group to receive/gain enough information. So, to receive detailed information, discussion will be done among four groups. (Paneru, 2015)

Following the requirements of a good focus group guideline, I prepared the guidelines based upon the themes/issues related to learning mathematics through ICT. FGD guideline was constructed based on research problem, objectives, literature review. The other necessary points were raised on the process of discussion as probing and hint will be given in each theme.

Validation of Tools

Every research demands high degree of validity because it is all of the empirical study of the phenomena. The research was made on the basis of checklist,

questionnaire, and FGD. The format of those all tools were prepared on the basis of review of related literature, conceptual framework and were verified by subject exports and supervisor. Also, it will be compared with the way of preparing checklist, questionnaire and FGD from related books, published and unpublished thesis Eid Alharbi et. Al. (2007).

Data Collection Procedure

The methods used to acquire data vary. However, because it is a qualitative study, I used first-hand information from primary sources to get my data. Prior to beginning the data collection, I personally visited the schools, spoke with the administrative staff members in charge, the head teacher, and the mathematics teacher of the schools, and requested permission to administer a questionnaire to students in classes 9 and 10 as well as the mathematics teachers of the sample schools of the sample districts.

I gave the observation checklist in each school to find out the ICT related materials. Teachers and students of sample group filled the checklist and the collected data were tabulated by using the Edwards's two-point scale. i.e., 1) exists and 2) does not exist.

After gathering the checklist, I explained the aim of the questionnaire to the teachers and students before administering the set of questionnaires. The respondents were asked to offer their insightful comments. One of the two questionnaire forms was distributed to the pupils, and the other to the teachers. I was explicit in my remark and asked if they had any trouble. Each responder was asked to check the box next to the statement they agreed, disagreed or were unsure about in any column. I performed a focus group discussion (FGD) to find out what they thought about the use of ICT in

math education and learning because some respondents to the questionnaire might have given inaccurate information.

In order to accomplish the study's goals, four groups of respondents-each with 8-10 members were organized, and FGDs were held with those groups. Participant respondents were kept on round table and one hour group discussion was done among them on the research topic and problems. The role of moderator and note keeper was played by the researcher i.e., me. Based on the study topic, objectives, literature review, and chosen theories, the FGD guideline was created for this. The FGD topics in each group were teachers, students' motivation, the current environment, beliefs, perceptions, and ideas regarding the use of ICT in mathematics teaching and learning. To examine how instructors' perceptions of learning through ICT to boost math performance differ from and are similar to one another, a group discussion using the FGD guidelines was held. The records of FGD among teachers was collected carefully. The information received from FGD was recorded in audio form in mobile phone and also noted in field note but taking permission from participant respondents. Finally, all the respondents to whom are consulted and school authorities of all school's administration and teachers were thanked for their kind co-operation.

Data Analysis and Interpretation Procedure

Data analysis is considered to be important step and heart of research in research work. After collection of data with the help of relevant tools and techniques, the next logical step is to analyze and interpret data with a view to arriving at empirical solution of problem (Paneru, 2015).

Data collected by using observation checklist, questionnaire and FGD guideline were analyzed and interpreted verbally and numerically by making themes.

The collected information from checklist, questionnaire and FGD were categorized according to the category of the respondents.

The checklist, all information were collected from primary sources by using Edward's two-point scale. To analyze the gathered data, the percentage score of each statement was determined.

After the observation checklist, all information was collected from the questionnaire by using Edward's three-point scale Agree, Neutral and Disagree. By calculating the matching $\chi 2$- value and comparing it to the tabulated $\chi 2$- value 5.991, which represents the value of $\chi 2$ at 0.05 level of significance with two degrees of freedom, the importance of each assertion was evaluated. The statement was deemed noteworthy if the calculated $\chi 2$- value was higher than the tabulated $\chi 2$- value. The conceptual knowledge of the study that was created theory was used to determine and interpret the percentage score of each statement.

More elaborately to explore the perceptual difference and similarities towards the use of ICT in mathematics teaching and learning among mathematics teachers, students, administration and student's motivation to learn mathematics, at first, I again listen the audio records of data on mobile phone after the collection of data besides the field. The researcher wrote down every vocal expression, viewpoint, and gesture made by the respondents as they were heard on the audio recordings and in the field notes. The original data was then conveniently translated into English. Some significant and valuable narrative was left unaltered, untranslated, and preserved in its original form. Then, similar topics and concepts were collected in one location while different data was collected in another. The study's theoretical framework was utilized to structure the theme and concept.

Mainly, those different themes such as the expectation of students and teachers, and satisfaction of students and teachers as well as suitable situation of learning through ICT were composed differently. Perceptual similarities and differences were used as the categories to analyze the text of FGD. After that similar themes of respondents were explained and analyzed descriptively by using constructivist theory.

Chapter IV

Analysis and Interpretation of Data

This chapter deals with the analysis and interpretation of the data. According to the set objectives of the study, researcher marked the responses of the students, very carefully and noted their outcomes systematically. Then on the basis of the observed and noted information the analysis and interpretation was carried out.

The information was collected through observation checklist, questionnaire, and focus group discussion with the students, teachers and administrator. This entire phenomenon comes under the fold of classroom practice. Classroom practice includes the relationship, interaction and communication between teacher and students for teaching and learning process.

The earlier research on computer uses in developing nations has demonstrated that these nations face more obstacles to ICT integration than other industrialized nations. The analysis focused on how frequently teachers used ICT for math instruction and learning. For their students, the teacher conducts live research. In order to better understand the benefits and challenges of educational technology in mathematics teaching and learning, researcher talked with teacher. The following major subsection, which relates to the study's goal, is where the results are presented. Where first point can help fulfill the first objective and other four points can help fulfill the second objective.

- Administrator's response towards ICT tools on the basis of their existence.
- Background information of students.
- Opinion of secondary level students towards use of ICT.
- Background information of teachers.
- Opinion of secondary level teachers towards use of ICT.

Administrator's Response towards ICT Tools on the Basis of their Existence

The first objective of this study was to find out the existing situation of using ICT in mathematics teaching and learning. To verify this objective, 13 secondary level private schools and 7 secondary level public schools of Kathmandu valley, Sindhuli and Mahottari districts were selected for the study. Here, the name of ICT tools, sampling score, and their percentage are tabulated below:

S.N.	ICT tools	No. of Schools	No. of ICT tools Exists	%	No. of ICT tools doesn't Exists	%
1	Overhead projector	20	17	85	3	15
2	TV	20	20	100	0	0
3	VCD/DVD	20	20	100	0	0
4	Camera	20	19	95	1	5
5	Radio/Cassette player	20	20	100	0	0
6	Photocopy Machine	20	17	85	3	15
7	Computer	20	20	100	0	0
8	Mathematical software	20	9	45	11	55
9	Printer	20	18	90	2	10
10	Scanner	20	12	60	8	40
11	Telephone	20	20	100	0	0
12	Fax	20	11	55	9	45
13	Cable TV Network	20	18	90	2	10
14	Internet	20	16	80	4	20

Background Information of Students

Two hundred students of different cast and language background were participated in the study. 70 students from Brahmin, 15 students from Jha, 5 students from Sha, 8 students from Yadav, 25 students from Magar, 30 from Chhetri, 16 from Dalit, 19 from Newar, 5 from Lama and 7 from Muslim community. 64% of the students were girls and 46% were boys with an average age group of 15 years.

All the students spoke English as their second language because their proficiency in English is low though schools have implemented English as the communication language in school periphery. In most of the public schools, the instruments had to be translated to their home language to facilitate the process of getting reliable information. Among 200 participants, 175 had computer in their home and other 25 did not have computer at home and their only access to computer was school's computer laboratory, which had a limited number of computers. (Appendix-B)

Perception of secondary level students towards use of ICT in mathematics teaching and learning

S.N.	Statements	No. of Students	Agree	%	Neutral	%	Disagree	%	χ^2-value	Decision
1.	Using computer at school improves my learning.	200	133	66.5	26	13	41	20.5	100.69	S
2.	ICT makes learning more interesting.	200	144	72	6	3	50	25	149.08	S
3.	I can get an access to computers at school whenever I need.	200	102	51	10	5	88	44	73.72	S
4.	I think ICT are	200	104	52	10	5	86	43	74.68	S

	essential for education.									
5.	I enjoy lessons with an ICT embedded.	200	136	68	44	22	20	10	112.48	S
6.	I feel comfortable working with computer.	200	106	53	24	12	70	35	50.68	S
7.	I believe that the more often teachers use computers, the more I will enjoy school.	200	102	51	47	23.5	51	25.5	40.31	S
8.	I have better information sources than ICT.	200	0	0	6	3	194	97	298.41	S
9.	ICT is very helpful in my learning.	200	109	54.5	13	6.5	78	39	72.01	S
10.	Computers scare me.	200	6	3	15	7.5	179	89.5	284.53	S
11.	I need help from teachers to learn with ICT.	200	34	17	24	12	142	71	128.44	S
12.	Computers are difficult to use.	200	16	8	10	5	174	87	259.48	S
13.	I find it time consuming using ICT in learning.	200	101	50.5	53	26.5	46	23	26.89	S
14.	Working with computer makes me nervous.	200	9	4.5	86	43	105	52.5	77.53	S
15.	I wish ICT is unwanted to use for teaching.	200	0	0	26	13	174	87	197.61	S

The second objective of this study is to explore the perception of students towards the use of ICT in mathematics teaching and learning. In order to achieve the objective, three-point Edwards type attitude scale were used and the data were obtained. The obtained score of student's perception is represented in percentage and χ^2-value. The response that has the greater than 50% score was considered as positive perception and below 50% score was considered as negative perception.

The first statement's response has a significant χ^2-value of 100.69 at the 0.5 level of significance, with 66.5% of students agreeing (i.e., positive reaction), 13% remaining neutral, and 20.5% disagreeing. This demonstrates that the response to this statement is significantly positive. Students responded to this, "*We can improve our mathematics if the school provides us ICT and teach us through it."*

Significant with a χ^2-value of 149.08 at the 0.05 level of significance, 72% of students agree with the second statement, indicating a positive response; 3% of students are neutral; and 25% of students disagree. This demonstrates that the majority of students concur that using ICT makes learning more engaging. The pupils then reacted as follows, *"like in other subject now I do not have problem in mathematics regarding the missing contents because I can easily recover those content watching the video."*

Significant with χ^2-value at 0.05 level of significance, the third statement received a response of 73.72, with 51 % of students agreeing (positive response), 5% neutral, and 44% disagreeing. This demonstrates that the majority of pupils agree that they can use the computers at school anytime they need to. They stated, *"we have sufficient amount of ICT materials in our school and we can use them whenever needed."*

In the fourth statement's answer, significant with χ^2-value of 74.68 at 0.05 level of significance, 52% of students agreed, indicating a positive response, 5% were neutral, and 43% disagreed. This demonstrates that more than half of the students concur that using ICT in education is necessary. They responded, "*ICT is very essential in modern learning context*."

Significant with χ^2-value at 0.05% level of significance is 112.48 in the response to the fifth statement, and 68% of students agreed, indicating a positive response. 10% of students disagree with this statement, while 22% are neutral. The majority of the pupils concured that they appreciate computer-based lessons. Some pupils reported that when they were taught utilizing ICT tools, they were really interested.

Significant with χ^2-value at 0.05% level of significance is 50.68 in the response to the sixth statement, with 53% of students agreeing (positive response), 12% being neutral, and 35% disagreeing. A little over half of the pupils expressed agreement with this. They retorted that using a computer to learn is really convenient.

Significant with χ^2-value at 0.05 level of significance, the response to the seventh statement from students was 40.38, meaning that 51% of them agreed, 23.5% were neutral, and 25.5% disagreed. The majority of pupils agreed with the claim that they enjoy school better if teachers use computer more frequently.

In the eighth statement's response, which has a significant χ^2-value at a significance level of 0.05 of 298.41, 3% of students are neutral and 97% disagree, which indicates the response is significantly negative. The assertion "I have better information source than ICT" was rejected by almost all students.

Significant with χ^2-value at 0.05 level of significance, the ninth response had a 54.5% positive reaction from students, a 6.5% neutral response, and a 39% negative

response. The majority of students believed, '*ICT is very helpful in the learning process*.'

Tenth statement answer: significant with χ^2-value at 0.05 level of significance is 284.53; 3% of students agreed, i.e., a negative response; 7.5% of students are neutral; and 89.5% of students disagreed. The majority of students disapproved of the claim that "computers scare me."

I need more aid from teachers to learn ICT, according to the response to the eleventh statement, which has a significant χ^2-value at 0.05 level of significance of 128.44 and 17% students who agreed, 12% who are indifferent, and 71% who opposed.

In the response to the twelfth statement, significant with χ^2-value at a significance level of 0.05 is 259.49, and 8% of students agreed, giving this statement a negative response. 5% of students were neutral and 87% of students disagreed. The majority of students disagreed with the claim that using computers is challenging.

In the response to the thirteenth statement, significant with χ^2-value at 0.05 level of significance is 26.89, and 50.5% of students agreed, i.e., a positive response; 26.5% of students were neutral; and 23% of students disagreed.

Working with computers makes me anxious, as indicated by the fourteenth statement answer, which has a significant χ^2-value at 0.05 level of significance of 77.53 and 4.5% of students who gave a negative reaction, 43% students who gave a neutral response, and 52.5% of students who gave a disagree response.

I wish ICT wasn't used for education, the fifteenth response's significant with χ^2-value at 0.05 level of significance is 197.61, 13% of students are neutral, and 87% disagreed, or gave a negative reaction.

The information above demonstrates how ICT use alters teaching in a number of ways. Teachers now have more influence over the classroom materials thanks to ICT than they did in the past because they can produce their own content.

Students connected through ICT with greater interest and motivation on their side. These opinions concur with several researchers' findings (for example; Watson et al., 1993; Cox et al., 1997). The use of interactive course materials, particularly games and simulations that combined real-world problems with educational opportunities, was very popular among students. Some replies suggested that such energy and motivation caused pupils to study harder but also to engage in involvement of different caliber. Student felt that using ICT tools helped them overcome obstacles to producing high-quality work, especially when it required handwriting, which decreased the possibility of instructor criticism. However, ineffective use of ICT tools could be extremely demotivating to students if they lack the necessary skills. Some students may feel less capable and successful after finishing homework on their own as a result of using ICT resources than they otherwise would.

According to constructivist theory, knowledge is not taught but rather acquired by the learner by building new knowledge on top of preexisting knowledge, in a particular setting, with the help of others like teachers or study partners, and by utilizing particular study materials. While teacher uses the setting, cooperation, and conversation to pique students' interests, activity, and creativity, the students act as the organizer, facilitator, and motivator as the main focus of the teaching and learning process (Liu, 2010).

Result from this study supports that learning through ICT does give positive impact in constructing student's knowledge. The researcher observed that students

had a strong motivation towards ICT. This demonstrates their interest in the prospect of frequently attending classes utilizing current mobile technology. This might encourage the kids to take advantage of the learning opportunity. In conclusion, what we can generalize from the above table is that the student's perception towards the use of ICT in mathematics teaching and learning is positive.

Background Information of Teachers

There were 121 mathematics teachers among 543 teachers: 100 teachers out of 121 were participated. Thus, 82.64% participation of mathematics teacher were obtained. Among them 5 was female teacher for secondary level with 3 years teaching experience, 3 female teachers having 3-month computer training, other 2 having 1 year computer training and all of them having computer with internet connection at their home. Other 95 teachers are male, only 40 teachers having more than 5 years teaching experience, 30 teachers having 3 years teaching experience, 16 teachers having 2 years teaching experience and 9 having less than 1 year teaching experience. Among the 95 male teachers, only 30 teachers had taken 1 year computer training, 25 teachers had taken 6 months computer training, 26 teachers had taken 3 months computer training and 14 didn't have any types of ICT training. Among 95 teachers, 76 had participated in different kinds of online teacher training during lockdown period caused by COVID-19. And all these 95 teachers have computer at their home. (Appendix-C)

Perception of mathematics teachers towards use of ICT in mathematics teaching and learning

S.N.	Statements	No. of teachers	Agree	%	Neutral	%	Disagree	%	χ^2-value	Decision
1.	I find it easy to think of ways to use computer in my teaching.	100	97	97	2	2	1	1	182.42	S
2.	ICT makes teaching more interesting.	100	96	96	3	3	1	1	176.78	S
3.	ICT makes teaching more difficult.	100	2	2	1	1	97	97	182.42	S
4.	ICT makes lessons more diverse.	100	0	0	2	2	98	98	154.90	S
5.	ICT decrease student's motivation.	100	0	0	3	3	97	97	149.21	S
6.	ICT improves the presentation of materials in lesson.	100	83	83	4	4	13	13	112.22	S
7.	ICT limits the content of my lesson.	100	86	86	5	5	9	9	125.06	S
8.	ICT makes preparing lessons quicker.	100	85	85	9	9	6	6	120.26	S
9.	ICT makes preparing lessons more difficult.	100	3	3	2	2	95	95	171.14	S

10.	ICT makes the lessons more fun for the students.	100	92	92	5	5	3	3	154.94	S
11.	ICT makes it more difficult to control the class.	100	6	6	3	3	91	91	149.78	S
12.	ICT often prevent teaching because of interruption in work or in software.	100	87	87	7	7	6	6	129.62	S
13.	ICT has given me more confidence to extend my use of computer to other topics.	100	88	88	6	6	6	6	134.48	S

The second objective of the study was to find out the perception of mathematics teachers towards use of ICT in mathematics teaching and learning. In order to achieve the objective, three-point Edwards type attitude scale was used and the data were obtained. The obtained score of teacher's perception is represented in form of percentage and χ^2-value. The perception scores greater than 50% was considered as positive and lower than 50% was considered as negative response.

In the response of first statement, significant with χ^2-value at 0.05 level of significance is182.42 and 97% of sampled teachers are agreed i.e., the response is positive, 2% of teachers are neutral and 1% of teachers are disagreed with the statement. Hence the statement has positively significant response.

In the response of second statement, significant with χ^2-value at 0.05 level of significance is 176.78 and 96% of sampled teachers are agreed i.e., the response is positive, 3% of teachers are neutral and 1% are disagreed with this statement. Hence majority of teacher has positive views that knowledge of using ICT makes teaching more interesting.

The third statement has significantly negative response with χ^2-value at 0.05 level of significance is 182.42 and 2% of sampled teachers are agreed, 1% are neutral and 97% teachers disagreed. Hence the majority of teachers are disagreed with the statement, 'ICT makes teaching more difficult.'

However, the fourth statement is significant with χ^2-value at 0.05 level of significance is 154.90 it has negative response, 98% of the teachers disagreeing with it. Which shows that majority of teachers do not believe that ICT makes lessons diverse.

In the response of fifth statement, significant with χ^2-value at 0.05 level of significance is 149.21 and 3% teachers are neutral and 97% disagreed i.e., negative response. Hence majority of teachers are disagreed that ICT decrease student's motivation.

In the response of sixth statement, significant with χ^2-value at 0.05 level of significance is 112.22 and 83% of sampled teachers are agreed i.e., positive response, 5% are neutral and 13% disagreed with the statement. Which shows that majority of teacher has positive views that ICT improves the presentation of material in lesson.

In the response of seventh statement, significant with χ^2-value at 0.05 level of significance is 125.06 and 86% of sampled teachers are agreed i.e., the response is positive, 5% teachers are neutral and 9% of teachers are disagreed with this statement. Hence majority of teacher has positive view that ICT limits the content of lesson.

In the response of eighth statement, significant with χ^2-value at 0.05 level of significance is120.26 and 85% teachers agreed i.e., positive response, 9% teachers are neutral and 6% teachers disagreed with this statement. Hence majority of teacher has positive view that ICT makes preparing lesson quicker.

In the response of ninth statement, significant with χ^2-value at 0.05 level of significance is 171.14 and 3% of sampled teachers are agreed, 2% are neutral and 95% disagreed i.e., the response is negative with this statement. Hence most of the teachers believe that ICT doesn't make the lesson more difficult.

In the response of tenth statement, significant with χ^2-value at 0.05 level of significance is 154.94 and 92% of sampled teachers are agreed i.e., positive response, 5% teachers are neutral and 3% of teachers disagreed with this statement. This shows that most of the teachers believe that ICT makes lesson more fun for the students.

In the response of eleventh statement, significant with χ^2-value at 0.05 level of significance is149.78 and 6% of sampled teachers are agreed, 3% are neutral and 91% of sampled teachers disagreed with this statement i.e., negative response. Hence most of the teachers disagreed that ICT makes it more difficult to control the class.

In the response of twelfth statement, significant with χ^2-value at 0.05 level of significance is 129.62 and 87% of sampled teachers are agreed i.e., positive response, 7% teachers are neutral and 6% teachers disagreed with this statement. Hence majority of teacher has positive view that ICT often prevent teaching because of interruption in work or in software.

In the response of thirteenth statement, significant with χ^2-value at 0.05 level of significance is 134.48 and 88% of sampled teachers are agreed i.e., positive response, 6% teachers are neutral and 6% teachers disagreed with this statement.

Hence majority of teachers believe that ICT gives more confidence to extend use of computer to other topics.

From the view of constructivist theory teaching through ICT in mathematics helps teacher to construct positive perception towards ICT and motivating students for learning mathematics. Also, Chong Che Keong et al. (2005) found that the efficacy of the lesson and the students' ability to understand essential concepts can both be enhanced by positive attitudes regarding the use of ICT in mathematics instruction. From literature review, Kalinga (2010) found that when ICT in e-learning that is available even in remote and rural secondary schools, student performance in secondary schools will improve, and teacher and student morale will increase. Sapkota (2015) found that ICT-based instruction motivates pupils to learn math more. This study also interpreted the result that students become more motivated to learn mathematics through ICT. ICT tools helped students to understand each topic and basic concepts of mathematics in better manner.

In conclusion, it is said that the perception of teachers towards use of ICT in mathematics teaching and learning in Kathmandu, Sindhuli and Mahottari districts is positive. They support the use of ICT. Their replies demonstrated the necessity of ICT for improved learning.

The Analysis of FGD

After examining the checklist and questionnaire responses, the research's organized focus group conversations are the main topic of discussion at this point. The objectives of this portion of the data analysis should be noted. At that time researcher discussed them informally on the basis of some questions:

1. What kind of ICT do you have?
2. Do you use any kind of ICT in the classroom?

3. What goals do you hope to accomplish with the help of ICT integration?
4. Can the pupils utilize ICT in the classroom?
5. Are half of the schools capable of using ICT?
6. What are the challenges in promoting ICT integration in schools?

When the researcher asked the first question to the group of Mathematics teachers then large number of respondents replied "*we have many more ICT tools like as computer, internet, different mathematical software, TV with cable connected, Android mobile, Radio cassette player, camera and sound recorder."*

When researcher asked the second question to the group of teachers' then large numbers of group respondents had common replied "*Yes, we have used technology in the classroom. Examples include using a mobile device to search for meaning, a calculator to perform calculations, the internet to llok up definitions, etc. We occasionally utilized a projector to display a visual diagram. The pupils have access to several websites where they can look up formulas and information about the topic's history and origin."* From the literatures review, According to Sapkota (2015), using ICT improved students' understanding of their subjects. Rendall (2001) indicated that ICT-assisted education was more successful at improving students' mathematical and logical reasoning abilities.

When the researcher asked third question to the group then most of the respondents cited based on four major areas are seen. The efficiency and speed gained in its application, both from the standpoint of lesson preparation and the efficiency with which the subject matter is presented during classes, is one of the main goals linked with the integration of ICT in the classroom:

'*ICT helps the teacher to vary teaching methods and provides time and effort for students as well as teacher.'*

The chance to offer practical, applied examples of theoretical concepts used in learning was another prevalent reaction. ICT can improve learning by increasing the chance for students to see visual representations of the work they have already done. Additionally, a more conventional perspective of ICT is that it boosts internet usage and concentrates students' attention on the subject matter.

ICT is viewed as a viable strategy by certain responders for raising student standards and outcomes:

'*Raising student levels in science and technology is the best goal I can hope to accomplish.'*

When the researcher posed the fourth question, the respondents generally responded favorably about the students' ICT skills as well as the resources they have access to at home. For instance, one respondent says the pupils are "better than the teachers", and another says they have never encountered a student without a computer at home. Another respondent described the limitations placed on students' usage of ICT in the classroom, taking into account both the teachers' expertise and the accessible technology:

'This depends on the type of technology used in the class and the teacher's ability in classes.'

Similarly, when the researcher asked the fifth question to the teacher's group the common response of respondents is positive about it. Some respondents said MOE has implemented some of the programs related to ICT in education. Some NGOs, trusts, and individuals have given computers, various accessories, and basic computer training to instructors as well as some schools (ICT in education Master plan, 2013).

The researcher found that the mathematics teachers were sometimes used the available ICT in their teaching. Internet resources were occasionally used by teachers

for instruction. The use of the school's computer lab is extremely limited, and it is typically used for purposes other than the teaching and learning mathematics. Even when educational technology tools are not being used, students and instructors have very positive evaluations of its application in mathematics teaching and learning. Therefore, after the discussion with teacher, the researcher found various problems, to use available resources. They are described critically below.

Economic problem. It says that school inputs, teacher inputs, student inputs and family inputs along with the national, community and school contexts act through the school process to determine student's outcomes. Using ICT is comparatively more expensive in itself.

The economic condition of student depends upon the economic status, implementation and sources available of their guardians and parents. Throughout this study it has been found that the economic level of their guardians is normal. The students of community-based schools are economically weak; they had many difficulties in their source management. So, on the question, "How many students have computer or not?" teachers replied "*only 65% students have computer at home but we have." (*Teacher's View)

This is the fact that the study of mathematics using computers at home is not possible for them. Since the teachers have easy access to use computers at home and school, they are not motivated to use it for teaching and learning Mathematics. When researcher asked, "Why do you not use ICT in teaching and learning?" teacher replied, "*Salary and facilities provided by school is not enough for us. We have to take tuition classes at different centers for little amount of money."* (Teacher's View) That is why they spend huge amount of time even to earn little money. They don't

have time to prepare to use ICT in teaching learning Mathematics. This also has discouraged the use of computer.

Lack of manpower. Another important category of school inputs, lack of adequate number of teachers is a serious problem. Neither the school administration not the CLCR is responsible for skillful teacher. Project has managed only one teacher for ICT integration. On the question, "Do you have knowledge to use ICT in teaching learning mathematics?" teacher replied "*we don't have enough knowledge, skill and idea to relate mathematics contents with ICT. This is something like affording a fish instead of teaching how to do fishing."* (Teacher's View)

Problem of time management. There seems to be problem in the management of time from all the sides, teachers, students, administration, CLCR project, school management committee and all other concerned bodies. The teachers, in the traditional vein are allocated 6-7 periods because of which they don't have time to use the computers. The school administration is unable to manage the time due to other responsibilities such as, curriculum implementation and teaching. The time per period, the number of students and the teachers, capabilities are quite imbalanced because of which the math teacher could not use their computer skills in teaching. On the question, "How much time is provided for mathematics classes to use the computer laboratory?" teacher replied "*We have to teach 6-7 periods per day. We are unable to manage time to go computer lab to search the information and if we want some time, the computer lab is usually busy."* (Teacher's View)

Since the computer is an obligatory subject in basic level, the labs are busy all time. So, this is impossible to teach other subjects using the computers. The school management committee doesn't seem much curious of such problems. This is not only about the time but also about other activities and plans, they seem quite

unconcerned. From the side of students, since they are taught tradition, the time could not be managed to each through computers.

Lack of training. According to Coley, Cradler and Engel, the training of teachers is crucial for successful and efficient use of ICT tools. ICT will be very useful for teachers to be in a position to purchase appropriate and relevant which will help in the development of high order thinking skills in Mathematics.

The primary agents of change at the school level, aside from the kids themselves, are the instructors and school administration. One of the first step in implementing any ICT-based educational plan is preparing teachers. If teachers are not totally comfortable with this new way of teaching, computers and instructional content won't have much of an impact on teaching and learning. Because of this, teachers must receive the necessary training in the relevant subject. Based on this situation, researcher asked, "Are you trained in how to use ICT in your subject?" some of the teachers replied, *"we are not trained how to use ICT in Mathematics."* (Teacher's View)

This demonstrates that the training is not focused on imparting knowledge of specific subjects. The training that math instructors require has not yet been provided. Although the project had taught about regarding teaching of mathematics, it is quite difficult to implement

Lack of mathematical software. It has been seen that appropriate software for mathematics teaching and learning in computer is not available. Even though they have math software, it is insufficient for them because it requires high-speed internet connectivity. Both their international partners and the administration of the school have not installed any offline mathematics program using internet. Therefore, another implementation issue is the lack of availability of certain piece of mathematical

software. Thus, the lack of enough mathematical software makes it difficult for the teacher to accommodate the different learning styles and curriculum needs.

Limited internet facility. While computers are essential tools for delivering ICT-based education, the full power of ICT in education can only be realized when these tools are connected to a wider network that allows users to access information from across the globe and share their knowledge with others.

The cost of the internet is high and it is difficult for school management to afford the cost. The speed of the internet is also quite slow. (Teacher's View)

It shows that there is not unlimited facility for teachers and students. This is because the internet service added much economic weight on the school. Since the schools had to pay high bill of internet, they could not afford the service. However, it is found that it is possible for normal use of internet by the teachers. This might be the reason that it is also costly to keep computers up to date for high speeds.

Insufficient ICT resources. One of the common problems in teaching using computers is the improper ratio of students with computers. School does not have sufficient tools of ICT. The unavailability of specific Mathematics software adds on the as another problem. Access to a wider range of ICT tools and appropriate use supports learning. Lack of enough ICT tools makes it difficult for teachers to accommodate the different learning styles.

Lack of policy. It is not necessary that they must have a practical aspect. Generally, Mathematical classes and environment are administrated in theoretical basis where no such ICT are used. Even in private sector, there is no such policy to use ICT in teaching Mathematics. That's why without a policy, it is difficult for the school to come up with logical and effective plans of how to use educational technology in the classroom environment.

Clearly, it is now time for policymakers and teachers to shift policy focus from quantity. By integrating ICT based teaching and learning approaches in mainstream pedagogy, we can enable students, teachers and families in different geographic and economic locations to access the same high quality educational resources. In particular, proper use of computers and modern networking technology has the potential to effectively address the problems of both quality and quantity.

Challenges in Promoting ICT Integration in Schools

The major challenge in our context is the required physical infrastructure for implementing ICT. In remote areas schools are like mud house where the wiring and putting desktop is itself a problem. Moreover, the government has now focused more on secondary schools for ICT related programs. In private schools too very few ICT related activities are found in urban areas. Many school children, thus, are out of the access to ICT in classrooms.

Policy related: The MOE has still not developed clear policies for integrating ICT into the classroom. In order to give every school, the chance to provide ICT facilities for their students, it is equally vital to convert the macro policies into micra ones.

Financial: MOE is unable to fund ICT in every school because salaries account for more than 90% of each school's budget. It will be extremely challenging to adopt ICT on government funds at a time when the bare minimum enabling circumstances do not exist in schools.

Teacher related: Most of the teachers in the system are traditional employed some 10 to 20 years back. Because of the teacher unions the MOE has not been able to manage teacher positions for the past 2 decades. And those traditional minded teachers are another challenge to implement ICT in schools.

Curricula related: Although Nepal has a system of continuous improvement in curriculum it cannot be done so frequently because of the distribution of free books in schools. So, it should wait for at least 5 years in changing curricula. The ICT will be coming in new shape every year but our curricula will be out of date by the time we install them based on existing efforts.

Sustainability: Twenty to percent of the total education budget comes from multi-donor agencies. This is the only money the government has for development purpose. The danger is that the development projects will not continue after the projects are over. Thus, the initiation of the government for ICT integration in education will follow the same suit.

From the above information, it can be summarized, there were perceptual both positive and negative perceptions towards use of ICT in mathematics teaching and learning among teachers, students and administrations. It was found that there is positive as well as negative effects of ICT but more positive and least negative effects of ICT was found in relation to the motivation of students to learn mathematics. Mathematics teachers, students and administration of school had mix (similar and different) and relative perception about ICT in relation to improve student's mathematical achievement and motivation to learn mathematics. Most of the teachers, students and administrations of private school were found favored existing percentage in comparison to the government school. (Appendix-D)

Chapter V

Summary, Findings, Conclusion and Recommendations

This chapter provides a brief summary of the study, states the findings of the study, gives concluding paragraph of the results of the study and suggests possible directions for future studies as recommendations.

The study was undertaken to examine the perception towards the use of ICT in mathematics teaching and learning. Especially the objectives of this study were:

- To uncover the praxis of using ICT in mathematics teaching and learning.
- To explore the perception of teachers and students towards the practices of ICT in mathematics teaching and learning.

The methodological design of this study was descriptive survey type. The population of the study was consisted of all the secondary level students of public and private schools of Kathmandu valley, Sindhuli and Mahottari districts on the academic year 2077/78/79. Total 200 students, 100 teachers and 20 administrators were selected for the sample from twenty secondary schools. Samples were chosen by random sampling method from each school.

To achieve the objectives of the study, data and information were collected through checklist, questionnaire and FGD. All the information was collected from primary sources by using Edward's two-point scale (Exist and doesn't exist) and three-point scale (Agree, Neutral and Disagree). The analyzed percentage score and chi-square test of each statement was determined and interpreted by using conceptual understanding of the study developed in literature review with selected theory. Perceptual similarities and differences were used as the categories to analyze the text of FGD.

Major Findings of the Study

On the basis of analysis of the data, the following findings are given:

- It is found that all of 20 schools in Kathmandu valley, Sindhuli and Mahottari have ICT tools.
- Among 20 schools, 4 schools used the ICT tools regularly, 11 schools used in necessity and remaining 5 schools did not use it at all.
- 8 out of 20 schools could not be able to use the ICT tools in mathematics learning due to the lack of teachers' training.
- Secondary level students had a positive perception towards using ICT in classroom.
- Around 80% teacher at technical stream who had got basic training and orientation about ICT, highly favored to ICT and positive perception towards it but remaining 20% teachers had negative perception towards ICT because they had not got any training and orientation about ICT.
- ICT helps to increase the flexibility in learning mathematics.
- ICT helps to decrease the student dependency towards their teacher for learning mathematics.
- The irregular students were also as equally benefited as regular students by the ICT integrated pedagogy.
- There is necessity of training, orientation program of both streams.
- Students are found interested when they are taught with ICT tools.

Conclusion

From the above findings of the study, it is concluded that the students and teachers of secondary level have positive opinion towards use of ICT in Mathematics. In existing situation, there is almost maximum positive perceptions, and

understanding among teachers, students and administrations towards ICT. Some of teachers have negative perceptions, misconceptions, misunderstanding and illusions towards ICT due to lack of sufficient information, knowledge and popularization among all stakeholders. Schools and teachers are sure and believe in ICT whether it increases student's mathematical achievement and learning. The researcher comes to the conclusion that government, MOE CDC and other concerned bodies should give information about the implementation and how to practice it in school. The researcher found that mathematics teachers of technical stream have positive perception about ICT because he/she has got basic training and orientation about ICT but least of teachers have negative perception and misunderstanding about ICT due to lack of sufficient information and knowledge. So, the researcher comes to the conclusion that perception about any system, process and event depends upon the knowledge and clear understanding about it. So, there is necessity of training, orientation and discussion programs about ICT.

It was found that students were enthusiastic learning mathematics with the help of ICT. Because of the rapid feedback that students received with the aid of ICT, the many visual, dynamic ICT tools (like Geogebra) help students to learn mathematics more deeply. Students expressed great interest and excitement in learning about the mathematical software. They placed a strong emphasis on spreading awareness of the ICT across the nation. It seemed that ICT may be a practical mathematical tool that could be applied to the teaching and study of mathematics at Nepalese high schools.

It is clear that information technology in general, and particular, does not actually signify significant changes in what is taught rather than how it is taught. A typical method of doing this is to replace outdated communication channels with fresh

options provided by information and technology and the internet. Using email for tow-way communication with students and websites to spread information can be very effective because it cuts down on communication noise, costs, and time. As a result, the previously teacher-centered educational activities started to shift to learner-centered one. Thus, ICT encourages students to take an active role in their education. Particularly, the use of calculators and computer technologies has the potential to significantly alter how the content of school mathematics is presented.

Recommendation

From the findings of the present study the researcher suggests the following recommendations:

Recommendation for the educational implication

- Mathematics teacher should be encouraged to use and adopt educational technology together with teaching method.
- The mathematics teacher should be encouraged to emphasize the group discussion and student's centered methods instead of regular lecture method.
- Ministry of Education (MOE) and NCED should encourage the teacher through training to improve the existing mug and jug method by use of ICT. For these NCED and MOE should organize the various training programs, workshops, conferences etc.
- Every teacher should be capable to introduce the technology as a method and media in their teaching learning activities. For this the teacher's personal effort as well as the effort by the NCED is required. Besides, there needs a change in teacher education curriculum to incorporate ICT tools-based pedagogies in academic programs.

- MOE should be able to introduce the new pedagogies which are based on educational technology. So that such pedagogy could be a milestone to bring the deprive children to the main stream of education.

Recommendation for further studies

Research on a large scale is needed to see if the findings of this investigation can be generated to other such type of schools, so the following areas should be focused:

- The existence of relationship between ICT tools usage and ICT policy.
- Effective training model of ICT tools usage in teaching and learning.
- Whether the recommendation made in this will be feasible to all other type of project.

References

Agrawal, D. P. (2018). Meaning of the Term- Descriptive Survey. *International Journal of Transformations in Business Management*, Issue No. 6.

Albirine, A. A. (2006). Teacher's attitudes toward information and communication technologies: teh case of Syrian EFL teachers. *Journal of Computers and Education, 47,* 373-398.

Allport, G. w. (1935). *'Attitudes' in Handbook of Social Psychology, ed.* . C. Murchison, Worcester: Clark University Press.

Bachman, L. F. (2002). Some reflections on task-based language performance assessment. *Sage Journals*, 43-476.

Barak, M., Watted, A., & Haick, H. (2016). Motivation to learn in massive open online courses. *Examining aspects of language and social engagement, Computer & Education*, 49-60.

Chen, C., & Wu, I. (2012). The interplay between cognitive and motivation variables in a supportive online learning system for secondary physical education. *Computers and Education, Vl-58,* 542-550.

Cohen, L., Manion, L., & Morrison, K. (2000). *Research Methods in education, (fifth Ed.).* NewYork City: Free Press.

Dostal, J. (2017). Experiments in Education Supported by Computer Use: Teachers' Attitudes towards Computers. *In proceedings of the 9th International Conference on Computer Supported Education (CSEDU2017)-Vol 2*, 248-254.

Ertmer, P. A. (1999). Addressing first-and second-order barriers to change: strategies for technology integration. *Educational Technology Research and Development*.

Govindasamy, T. (2002). Successful implementation of e-Learning. *Internet and Higher Education*, 287-299.

Kahn, W. A. (2001). Holding Environments at Work. *The Journal of Applied Behavioral Science*, 260-279.

Kalinga, E. (2010). *Development of an interactive e-learning management system for Tanzanian secondary schools.* Karlskrona, Sweden: Blekinge Institute of Technology.

Katrina Roen PhD. (2007). Review: U. Flick (2006). An Introduction to Qualitative Research. *Qualitative Research in Psychology*, *4:3*, 259-260, DOI: 10.1080/14780880701473623.

KEMP, M. (2014). Learning Experiences to Promote Mathematics Learning . *Learning Algebra and Geometry through ICT*, 269-293.

Mayer, T. (2004). Teview of e-learning theories framework and models. *JISC, e-learing models desk study*, http//www.Jisc.ac.uk/uploadeddocument/stage learning models version201.pdf.

Moila, M. M. (2006). *The use of Educational Technology in Mathematics Teaching and learning: An investigation of South African Rural secondary school.* University of Pretoria: Unpublished Mini-dissertation.

Mulenga, E., & Phiri, P. (2018). Zambian Teachdrs' Profiles of ICT Use in Mathematics Pedagogy. *Journal of Basic and Applied Research International, Vl-24*, 137-148.

NCES, N. (2000). Fast response survey system. *Survey on Public School Teachers Use of Computers and the Internet*, FRSS 70, 1999.

Njagi, D. W. (2014). Teacher's perspective towards Differentiated Instruction Approach in Teaching and learning of mathematics in Kenya. *International Journal of Humanities and Social Science, Vl-4*, 54-59.

Paneru, T. N. (2015). *Letter Grading system Assessing Mathematics achievement: Issues and Challenges.* University Campus, Kirtipur: Unpublished Thesis.

Patton, M. Q. (1990). *Qualitative Evaluation and research Methods (Third Ed.).* London: Sage.

Phutela, N., & Dwivedi, S. (2019). Impact of ICT in Education: Students' Perspective. *Proceedings of International Conference on Digital Pedagogies*.

Richard, N., & Haya, A. (2009). Examining student secision to adopt web 2.0 technologies: theory and empirical tests. *Journal of computing in higher education, 21(3)*, 183-198.

Sapkota , B. (2015). *Effectiveness of information communication technology integrated pedagogy at secondary level.* University Campus, Kirtipur: Unpublished thesis.

Shrestha, S. (2018). *ICT in education.* Kathmandu: The Kathmandu Post.

Upadhyay, H. P. (2001). *Constructivism in Teaching Mathematics.* Doctoral Dissertstion: Chandigadha University India.

Wang, X., & Dostal, J. (2017). An Analyssi of the Integration of ICT in Education from the Perspective of Teachers' Attitude. 10.21125/edulearn.2017.0507.

Wright, V., Wilson, E., Gordon, W., & Stallworth, J. (2002). Contemporary Issues in Technology and Teacher Education, 2(3). *Master technology teacher: A partnership between preservice and inservice teachers nad teacher educators*, 353-362.

Yadav, S. (2016). *Opinion towards the practices of e-learning in Mathematics.* University Campus, T.U., Kirtipur: Unpublished Thesis.

Appendices

Appendix-A

Observation Checklist for Administrators

Dear administrator,

I am student of mathematics education in Central Department of Education in T.U. Kirtipur, Kathmandu. I am doing research on "Perception towards the use of ICT in Mathematics Teaching and Learning", the main objectives of my research is to find out the existing situation of using ICT in mathematics and to find out perception of students and teacher towards use of ICT in mathematics. To fulfill the objectives of the study, I would like to take your view and idea about use of ICT. Your view and ideas are only used to complete this study not for other purpose. I hope you do not feel any difficulty to help me to complete my study.

Name of the administrator:

School Address:

Contact No.:

Sector: 1. Public 2. Private

Gender: 1. Female 2. Male

Age: … … …

Number of secondary teachers: … … …

Number of basic level teachers: … … …

Number of years in administrating: … … … Year/Years

1. Please check out one option each.

   A. Did you receive any training on ICT before or after you joined this School?

      a. Yes b. No

B. Do you have an ICT department or ICT unit in your school?

a. Yes b. No

C. If the response is 'No' in question no. '2', do you have plan to introduce ICT in you school?

a. Yes b. NO

2. Please check out among the following ICT tools on the basis of their existence at your school.

S.N.	Name of the ICT tools	Exists	Does not Exists
1	Overhead Projector		
2	TV		
3	VCD/DVD		
4	Camera		
5	Radio/Cassette player		
6	Photocopy machine		
7	Computer		
8	Mathematics software		
9	Printer		
10	Scanner		
11	Telephone		
12	Fax		
13	Cable TV network		
14	Internet		

Appendix B

Questionnaire

Dear students,

I am student of mathematics education in Central Department of Education in T.U. Kirtipur, Kathmandu. I am doing research on "Perception towards the use of ICT in Mathematics Teaching and Learning", the main objectives of my research is to find out the existing situation of using ICT in mathematics and to find out perception of students and teacher towards use of ICT in mathematics. To fulfill the objectives of the study, I would like to take your view and idea about use of ICT. Your view and ideas will only be used to complete this study not for other purpose. I hope you do not feel any difficulty to help me to complete my study.

Name of Student:

School's Name:

Class:

Sector: 1. Public 2. Private

Gender: 1. Female 2. Male

1. Do you have computer at home?

   a. Yes b. No

2. If yes, is the computer connected to the internet?

   a. Yes b. No

3. Do you use your computer at home for your school work?

   a. Yes b. No

If yes, please explain how?

.....

.....

4. At school, on a weekly basis, I use computer and it's applications for learning purposes.

a. Never b. One hour c. Two hours

d. Three hours e. Four hours f. More than four hours

5. At home, on weekly basis, I use computer and it's applications for learning purpose.

a. Never b. One hour c. Two hours

d. Three hours e. Four hours f. More than four hours

6. How long have you been using computer and it's applications for tearing purpose either at school or at home?

a. Never b. Less than One year c. One years

d. Two years e. Three years f. More than Three years

7. At school, on a weekly basis, I use computer for learning purpose.

Time	Mathematics	Science	English language	Other Subjects
Never				
1 hour/ week				
2 hours/week				
3 hours/ week				
More than 3 hours/ week				

8. Please place a tick in one of the three boxes next to each statement.

S.N.	Statements	Agree	Neutral		Disagree
1.	It is important that I use computers in my learning because it makes				

	my school work easy.				
2.	Using computers at school improves my learning.				
3.	When I use computers, they make learning more interesting.				
4.	I make good use of email at school.				
5.	I can get an access to computers at school whenever I need to.				
6.	I think ICT are essential for education.				
7.	I use computer at school to do the following task.	Never	Daily		Weekly
A.	Writing				
B.	Email				
C.	World Wide Web				
D.	Mathematics learning				
E.	Playing Games				
F.	Others				
8.	I use computer at home to do the following task.	Never	Daily		Weekly
A.	Writing				
B.	Email				
C.	World Wide Web				

D.	Mathematics learning				
E.	Playing Games				
F.	Others				

9. Your opinion about using computer in the teaching/learning process. (Please tick one box on each row)

S.N.	Statement	Agree	Neutral	Disagree
1.	I enjoy lessons with a computer.			
2.	I feel comfortable working with computers.			
3.	I believe that more often teachers use computers, the more I will enjoy.			
4.	I am tired of using computer.			
5.	I have better information sources than ICT.			
6.	ICT is very helpful in my learning process.			
7.	Computers scare me.			
8.	I need help from teachers to learn with ICT.			
9.	Computers are difficult to use.			
10.	I find it time-consuming using ICT in learning.			
11.	I know how to use ICT but am not interested in using ICT in learning.			
12.	Working with computers makes me nervous.			
13.	I wish ICT is unwanted to use for teaching and learning process.			

Appendix C

Questionnaire for Teachers

Dear administrator,

I am student of mathematics education in Central Department of Education in T.U. Kirtipur, Kathmandu. I am doing a research on "Perception towards the use of ICT in Mathematics Teaching and Learning", the main objectives of my research is to find out the existing situation of using ICT in mathematics and to find out perception of students and teacher towards use of ICT in mathematics. To fulfill the objectives of the study, I would like to take your view and idea about use of ICT. Your view and ideas are only used to complete this study not for other purpose. I hope you do not feel any difficulty to help me to complete my study.

Name of the teacher:

School Address:

Contact No.:

Sector: 1. Public 2. Private

Gender: 1. Female 2. Male

Age:

Number of years in teaching mathematics: …… Year/Years

1. Please check out one option each.
   A. Did you receive any training on ICT before or after you joined this School?
      a. Yes b. No
   B. Do you have an ICT department or ICT unit in your school?
      a. Yes b. No

C. If the response is 'No' in question no. '2', do you have plan to introduce ICT in you school?

a. Yes b. NO

D. Has your school allocated school budget for the implantation of the ICT?

a. Yes b. No

2. Your opinion about the use of ICT in mathematics teaching and learning process. (Please tick one box only in each row)

S.N.	Statement	Agree	Neutral	Disagree
A	I find it easy to think of ways to use computer in my teaching			
B	ICT makes teaching more interesting.			
C	ICT makes teaching more difficult.			
D	ICT makes my lessons more diverse.			
E	ICT decreases student's motivation.			
F	ICT improves the presentation of material in my lesson.			
G	ICT limits the content of my lesson.			
H	ICT makes preparing lessons quicker.			
I	ICT makes preparing lessons difficult.			
J	ICT makes the lessons more fun for the students.			
K	ICT makes it more difficult to control the class.			
L	ICT often prevent teaching because of interruption in work or in software.			
M	ICT has given me more confidence to extend my use of computer to other topics.			

3. How many days did you have a face to face training?

……

4. How often did you have computer practice after training?

……

5. Were you trained in technical support for your school?

   a. Yes b. No

6. Do you use information from the internet for teaching purpose?

   a. Yes b. No

7. Do you see any barriers to your use of technology?

   a. Yes b. No

8. Where are the computers located in your school? (Check all the apply)

   - Computer lab
   - Library
   - Classroom
   - Administration areas
   - Others ……

9. How long has the school been using computers?

   - Not yet used
   - Less than one year
   - Less than five years
   - Five years and above

10. The school's computer networking environment is:

    - All the computers are networked
    - Some of the computers are networked
    - None of the computers are networked.

11. In your view, what is the importance of using ICT in this school? (Check out as many as applicable)
    - Enriching teaching learning
    - Finding information in internet
    - Communication with others
    - Development of ability to use ICT
    - Management of functional operations
    - Students assessments
    - Others …….
12. In your opinion, the sue of ICT at schools generates:
    - Motivation
    - Willingness to learn
    - Work satisfaction
    - Operational efficiency
    - Others …….
13. In your opinion, which of the following are the major problems handing the adequate use of ICT at your school? (Please check all that apply)
    - Financial constraints
    - Lack of skilled manpower
    - Lack of adequate human resources
    - Space problem
    - Lack of readiness to introduce new technology

Appendix D

FGD Guideline for the Teachers

FGD among teachers based on the following points/topics:

- Perception about use of ICT.
- Understanding and Knowledge of ICT.
- Advantage and disadvantage of using ICT in teaching and learning.
- Motivated and demotivated from ICT.
- Feeling of competition among students, teachers after ICT was implemented.
- Satisfaction from ICT tools received in Mathematics.
- Home and school environment for mathematics teaching and learning.
- Uses of ICT tools in teaching and learning in mathematics.

Some of the model questions for FGD are listed here:

- What kind of ICT do you have?
- Do you use any kind of ICT in the classroom?
- What are the objectives that you want to achieve through the integration of ICT?
- Are the students capable of using ICT during classes?
- Are half of the schools capable of using ICT?
- What are the challenges in promoting ICT integration in schools?

Appendix – E

Formula used for data analysis

Chi-square Value ($\mathcal{X}^2$-value) = $\sum \frac{(f_o - f_e)^2}{f_e}$

Where, f_o = Observed frequency

f_e = Expected frequency

Appendix F

Name of the Schools

S.N.	Name of schools	District	Sectors
1.	Shankhareshwar Secondary school, Marin	Sindhuli	Public
2.	Janajyoti HSS, Phosretar	Sindhuli	Public
3.	Gaumati Namuna HSS, Madhibazar	Sindhuli	Public
4.	Shindhu Subha Prabhat School, Dhurabazar	Sindhuli	Private
5.	Shining Moon Academy, Madhutar	Sindhuli	Private
6.	Suryodaya English Boarding School, Ratmata	Sindhuli	Private
7.	Bidhyashram Secondary English School, Dhungrebas	Sindhuli	Private
8.	Mangal HSS, Kirtipur	Kathmandu	Public
9.	Shankhar School, Nayathimi	Bhaktapur	Public
10.	Creative Academy, Kirtipur	Kathmandu	Private
11.	Everest English School, Bhaktapur	Bhaktapur	Private
12.	Prashanti Academy, Kapan	Kathmandu	Private
13.	Eden Garden Academy, Nayathimi	Bhaktapur	Private
14.	Pushpalal Shikshya Sadan, Kapan	Kathmandu	Private
15.	Golden Pick English School, Kapan	Kathmandu	Private
16.	Janata HSS, Bardibas	Mahottari	Public
17.	Shree Deurali Secondary School, Bardibas	Mahottari	Public
18.	Globle Academy, Bardibas	Mahottari	Private
19.	Sunshine Secondary Boarding School, Bardibas	Mahottari	Private
20.	Sapta Kabindra Shiksha Niketan	Mahottari	Private

Appendix G

Research matrix

Perception Towards the use of ICT in Mathematics Teaching and Learning				
SN	**Research Question(s)**	**Objective(s)**	**Sources of Data**	**Tools of Data Analysis**
1.	What are the present circumstances for practice of ICT in mathematics in school?	To find out the existing situation for practices of using ICT in mathematics teaching and learning.	Primary	Percentage Score χ^2-value
2.	What are the opinion of Mathematics teachers and students towards ICT?	To find out the perspective of teachers and students towards the practices of ICT in mathematics teaching and learning.	Primary	Percentage Score χ^2-value