

CHAPTER I

Introduction

Background of Study

ICT in Education means teaching and learning by use of ICT. Information and communication technologies (ICTs) are currently being used in education to assist students to learn more effectively by providing teachers with access to a wide range of new pedagogy. These technologies are also being used to enable teachers to do administrative tasks more efficiently. Information and communication technology (ICT) can complement enrich and transform education for better.

ICT in education has multiplier effect throughout education system, by enhancing learning and providing students with new set of skill; by reaching students with poor or no access (especially those in rural and promote regions); by facilitating and improving the training of teachers; and by minimizing costs associated with traditional instruction (UNESCO, 2014). Yusuf (2007) described ICT as electronic technology used for accessing, processing, gathering, manipulating, presenting and communicating information. He emphasized that when ICTs are employed in education, they can accelerate, enrich and deepen basic skills in reading, writing, arithmetic and the sciences beside motivating and encouraging students to learn as they became more independent are responsible for their learning. (Cited by Dhital (2018),

Information communication and technology is a tool (Nwakundo, Oguejiofor and Nwankwo, 2006) that comprises electronic devices which are utilized for the information and communication needs of institutions, organizations, students and individuals. Such electronic devices include computers (software and hardware), networking, telephone, video, multimedia and internet. Application and utilization of these devices convert information, text message, sounds and motion to common digital forms. Therefore, information and communication technology in education is the use of all forms of technology assisted programs, popularly known as TAI (Television Assisted Instruction), RAI (Radio Assisted Information), CAI (Computer Assisted Instruction), Mobile Learning and IAI (Internet Assisted Instruction).

At end of Second World War, the first electronic digital computer ENIAC having 1800 vacuum tubes was made. On less than 40 year later, many handheld computers are available all over the world. With the help of ICT systems the internet

became the part of our lives (Acharya, 2015). The phrase information and communication technology has been used by academic researchers since the 1980s, and the abbreviation ICT became popular after it was used in a report to the UK government by Dennis Stevenson in 1997 and in the revised National Curriculum for England, Wales and Northern Ireland in 2000. But in 2012, the Royal Society recommended that ICT should no longer be used in British schools "as it has attracted too many negative connotations", and with effect from 2014 the National Curriculum uses the word computing, which reflects the addition of computer programming into the curriculum. Variations of the phrase have spread worldwide, with the United Nations creating a "United Nations Information and Communication Technologies Task Force" and an internal "Office of Information and Communication Technology"

ICT in Nepal

Computer in Nepal came into existence only in 1972 for utilization of it in public census on rent, monthly NPR 1, 25,000 which was installed in Electronic Data Processing Center under Central Bureau of Statistics and this Bureau was, turned into National Computer Center (NCC) in 1975 in autonomous capacity, which collapsed right after establishment of ministry of science and technology.

ICTs in School Education in Nepal

In education of Nepal, computer was first utilized for publication of SLC results in 1981 in collaboration with National Computer Center and continued until in- house computer system was established in Office of Controller's Examination in 1988. However, these efforts only using ICT for smooth office operation rather than use of ICT for pedagogical purposes. Right after restoration of multiparty democracy system in the country, new curriculum 1992 was implemented, this provisioned the access to those who were willing to learn computer science as a subject from the list of optional subject from elective area still exist in school curriculum and first SLC graduates with computer science appeared from SLC examination of 1995 and onwards.

However, the effort for integrating ICT in teacher preparation and professional development programs seems to be not encouraging that limits up to trainer develop programs with provision of multi-media labs in training center under National Center for Education Development (NCED) system of Ministry of Education (MOE). However, government programs for supporting computers provisions for school got low priority until implementation of EFA II (2004-2009). Now, at the moment in the

implementation process of SSRP, 2009 onward up to now government has committed to support school computer program with matching fund of NRS 2, 00, 000 per school if they claim that they have computer infrastructure and government provides 80% of committed sum as their share and provide computer training to teachers.

One Laptop Per Child (OLPC) was another government's effort in utilizing ICT in school education in 2007. OLPC was pilot program in 26 primary schools of 6 districts, implemented in collaboration with Open Learning Organization (OLE), an NGO in Nepal. This OLPC program could not satisfy clientele needs and government did not expand it in national scale. However, innovative works done by OLE are considered to be e-library, presently, Government has made ICT program provision supporting those schools who claim they have computer infrastructure through matching grant of NRS 2, 00,000, of which school share is to be NRS 40,000, for buying 4 computers and one printer. Computer as a medium of instruction is being utilizing in the form of multimedia classroom (a projector, screen of large LCD, speaker and a classroom computer), computer lab (single seat or multiple seat) and single station having personal computer (PC, microcomputer, laptop or notebook, and small devices such as tablets, smart/mobile phone, and e-readers) in one-to-many and one-to-one approach.

Education has been considered as a fundamental right of the people by Interim Constitution of Nepal 2007. Nepal has developed and implemented number of policies and programs provision that emphasis on ICT on education, like National IT policy (2010, 2015), 10th plan (2002-2015), Three Years Interim Plan (TYIP, 2007-2010, 2010-2013), School Sector Reform Plan (SSRP, 2009-2015). The Government of Nepal (GON), Ministry of Education (MOE) has introduced various interventions in order to achieve the goal of education in Nepal. Use of Information and Communication Technologies (ICT) in education has been considered as one of the strategies to achieve the broader goal of education. The government of Nepal, Ministry of Education, through National Curriculum Framework (NCF), has introduced ICT as a subject as well as ICT as a tool for instruction in school education. The implementation of the Information and Communication Technology in Education Master Plan (2013-2017) has increased access to computers and the internet in school, which allows for the scaling-up of ICT in school education.

The ICT objectives of the recent national education plan School Sector Development Plan (SSDP, 2016-2023) are; (a) the appropriate use of ICT to improve

classroom delivery by establishing an ICT enabling learning environment (including institutional and professional capacity of manager and implementers) and based on need and context, (b) Appropriate development access to learning materials and supporting professional development package and guidelines to ensure adequate capacity for incorporating these in the curriculum, (c) The use of ICT for improvement and increased effectiveness and efficiency of overall educational governance and management. SSDP's strategies for improving knowledge of the use of ICT as follows:

- Establish an ICT enabling learning environment by including ICT prerequisites as enabling condition in government schools and the provision of ICT infrastructure and teaching learning materials for pedagogy.
- Establish ICT learning centers in schools with enhanced teaching-learning processes.
- Incorporate ICT in the government curriculum through the development of professional development packages and guidelines.
- Develop need based educational materials for children with visual and hearing impairment and support computer education in government deaf schools.
- Develop portals and websites including e-libraries.
- Train teachers on the use of ICT in teaching learning.
- Develop online and offline training courses and materials (focusing on science, math and English).
- Prepare ICT teaching and learning materials, initially for science, maths and English.
- Develop and distribute subject-wise-e-learning resources for students and teachers and establish a repository of them.
- Strength school governance and management through a strengthened EMIS (Educational Management Information System), including the enhanced use of ICT to improve the EMIS and implement a unified accounting software, the Computerized Government Accounting System (CGAS) in MOE.

In the context of Nepal, Nepal has developed and implemented number of policies and programs provision that emphasis on ICT on education but no satisfactory result was found. According to (Dhital, 2018); the development of information and communication technology in government education is faced with

many challenges. So far, ICTs have not been used as a way of acquiring new knowledge and skills in schools of Nepal due to inadequacy of curriculum content and limited access to ICTs. Other challenges include inadequate funding, lack of basic infrastructure, lack of qualified personnel and lack of policy formation and implementation.

In the era of 21st century, use of technology play a vital role in teaching learning mathematics. In mathematics education, the technology that affords the greatest promise is the hard-held, programmable, computer software, graphing calculator (Acharya, 2015). The mathematical software is very good guide to the solution to a lot of mathematical tasks. Without knowing the issue, the application of mathematical software often result in lot of errors as well as a wrong interpretation of results (Courant, Robbins, and Stewart, 1996; Cited by Acharya, (2015)). Using mathematical software and new technologies bring not only new, strong and difficult problems but also new challenges especially in didactics. Therefore, a role of teachers seems to be more challenging, similar as teachers' training.

Various researches done by Kaur (2003), Myers (2009), Sapkota (2015); Acharya (2015), and Zovko (2016) in favor that ICT based teaching is more effective than not utilizing ICT in teaching.

Hudson (2008) found that lack of access to computer labs and lack of lesson plan are the main barriers to using ICT in mathematics teaching in Australia. Kumau (2012) found that lack of staff, access computers, low speed internet, lack of basic computer training are the main challenges in Secondary Schools in Nyandarua South District.

Ngimi (2013) found that lack of pedagogical competences by majority of lecturers, lack of ICT technical support at the institute level and access to ICTs due to inadequate infrastructure in the institute in the Institute of Continuing Education at the Open University of Tanzania are the challenges of integrating ICTs in education delivery.

Nkhwalume (2013) found that lack of access of computers, inadequate contact time for mathematics, and lack of support from administrators are major challenges. And Ghimire (2017) found that the problem faced by teachers due to school administration, teaching materials, classroom management, mathematical concept and student's background are the challenges of integrating ICT into the mathematics curricula in the SADC Region.

In the above context, many government and non- government official research, policies and provisions indicate that huge amount of time and money have been spent to find the solution of the challenges of teaching mathematics with ICT but no satisfactory result was found. Hence no successful solution can be found to address the teacher's challenges in teaching mathematic with using ICT at secondary level. Thus, the purpose of the present study is to identify the kinds and extends of challenges faced by mathematics teachers in using ICT in teaching mathematics at secondary level and to explore the possible solution to the challenges. So, this study is focused on identifying the challenges they faced while teaching mathematics by using ICT and exploring the possible solution to the challenges.

Statement of the Problem

The advancement in the science and technology has brought sophisticated change in the world among them education sector is one, which is considered as a backbone of development. There are tremendous advanced technological tools has been developed for teaching and learning globally. These tools have been implemented already successfully in international education system.

In context of Nepal, School Sector Reform plan (SSRP, 2009-015) was implemented and expands ICT associated teaching/learning strategies in all schools and to development ICT infrastructures in school (Joshi, 2017 cited by Acharya S., 2019). The recent School Sector Development Plan SSDP (2016-023), aims to use ICT as a significant tool to improve classroom delivery, maximize access of to teaching materials and enhance the effectiveness and efficiency of educational governance and management. The IT policy (2067), three year plan (2011-2013) of Government of Nepal (GON) has included some policy and strategies in order to develop and integrate ICT in education (MOE, 2013). These policies have been limited only on the paper and government plan has not gone as mentioned in the policy documents.

In spite of these several efforts, it can be found that there is not any positive improvement in the students' achievements and still teachers are facing the challenges in using ICT in classroom. That is why; the researcher selected this topic to explore the possible solution to the challenges faced by mathematics teachers in using ICT. This study intends to the answer the following questions.

- What are the challenges faced by mathematics teacher in using ICT in teaching mathematics at secondary level?
- What are the possible solutions to the challenges faced by teacher in using ICT in teaching mathematics at secondary level?

Objectives of the Study

The main objectives of this study were as follows:

- To identify the challenges faced by mathematics teacher in using ICT in teaching mathematics.
- To explore the possible solution to the challenges faced by teachers in using ICT in teaching mathematics.

Justification of the Study

This section discusses the value and benefits which associate with the study. This study may provide some logical and valuable information about current challenges faced by mathematics teachers in using ICT in teaching mathematics at secondary level of Kalaiya Sub-Metropolitan of Bara district and possible solutions to the challenges. Thus this study is significant for mathematical curriculum developer, policy maker, teacher's trainers, school administration, mathematic teachers, and students. The study has the following significance:

- This study would help to identify the challenges faced by secondary mathematics teachers in using ICT in mathematics teaching.
- This study would help to give suggestion for the improvement in the solution of challenges.
- This result of the study would help the school to provide support and training to teacher on the use of ICT in teaching mathematics.
- The study would help the curriculum planer to find the challenges of teachers in using ICT and possible solution related to challenges and prepared curriculum.
- The study would contribute information to the policy makers that could help them to formulate their teacher training programs involving ICTs for education.

- The study is helpful for teacher trainers at various teacher training institutions would be made aware of the challenges in utilization of ICT instructional resources so that they would incorporate them in training.

Delimitation of the Study

Delimitations are the boundaries of the study. These are restrictions intentionally was placed by the researcher. The delimitation of the study were as follows.

- This study was concerned only the challenges faced by mathematics teacher in using ICT tools in teaching mathematics.
- This study was limited to Kalaiya Sub Metropolitan, Bara district.
- In this study, not all secondary schools in Kalaiya Sub Metropolitan, Bara district was covered.
- The study was delimited on 30 mathematics teachers of secondary level of Kalaiya Sub Metropolitan, Bara District.
- The study was delimited only on computer, multimedia and projector as ICT's tools.

Operational Definition of Key Terms

Different words can give different meaning according to the context in which they are used. Hence researcher feels it necessary to define following terms which would be frequently used in this study.

Secondary School Mathematics Teacher. The teacher who teaches mathematics at grade 9 and 10 on Bara district was considered as secondary school mathematics teacher.

ICT (Information Communication and Technology). An umbrella term referring to a wide range of Software technology component such as computer, telecommunication, internet, video and digital cameras that can be used by teachers to support their work.

Computer. Is a machine that automatically accepts, stores and processes data to produce information.

ICT Tools. In this research, ICT tools refer computer, multimedia, projector used in secondary level school in Kalaiya Sub- Metropolitan of Bara.

Computer Software. Is the collection of computer programs and related data that provides the instructions telling what to do?

Computer Hardware. These are the physical components of a computer.

Attitude. Having inclined interested and emotion towards ICT in mathematics.

Challenge. Barriers in using ICT in teaching mathematics.

Learning. Understanding mathematical concepts and ability to apply them in different situation.

Teaching. Passing Knowledge of new mathematical concept and skills of problem solving.

Trained Teacher. The teacher who have passed bachelor or higher level in mathematics education or were taken 10 months training provided by MOE or NCED or FOE are defined as trained teachers.

Classroom Management. The appropriate management of ICT based classroom.

Access of Technology. Access of teachers, students and administration to the use of ICT tools.

CHAPTER II

Review of the Related Literature

The review of related literature deals with the theories or research studies. It helps to conduct the new research in systematic manner by providing the outline of the research and avoiding the unnecessary duplication. Some studies related to this study have been reviewed as follows.

Empirical Literature

Kaur (2003) did research on “The Use of ICT in the Teaching of Mathematics by Perspective Mathematics Teachers”. The study seeks to understand just how much of the use of IT and the accompanying skills demonstrated by Mathematics teachers are a direct translation of the skills and pedagogies learnt as part of their pre-service teacher at NIE. In this study 27 trainee teachers selected as sample. The trainee teachers were introduced to the use of ICT in mathematics lessons. A total of 8 hours was spent on this. There were 5 types of ICT that trainees used. These were Internet websites, Geometer’s Sketchpad (GSP), Microsoft PowerPoint, CD-ROMs and Microsoft Excel. This study shows that teachers are able to apply what they have learnt and customize their teaching materials for their own classroom needs.

Hudson (2008) did research on “Barriers to Using ICT in Mathematics Teaching: Issues in Methodology”. The aim of this study is to investigate the barriers to using ICT in mathematics teaching. The sample contained 114 mathematics teachers from public secondary schools in New South Wales (Australia). The instrument used in this study was a survey questionnaire mailed to secondary schools in the New South Wales Department of Education and Training. The questionnaire design is a closed-response with five open-ended questions. Research of this study showed that lack of access to computer labs is the number one barriers to using ICT in the classroom. But when a second analysis using a logistic regression analysis modeling was used, the non-users of computers paint a different picture. The number of teachers indicating lack of lesson plans as a barrier was significantly higher for teachers who do not use technology than teachers who do not use technology in the classroom.

Myers (2009) did research on “Effects of the Use of Technology in mathematics Instruction on Student Achievement”. The purpose of this study was to examine the effects of the use of technology on students’ achievement, particularly the Florida Comprehensive Assessment Test (FCAT) mathematics results. In this

study eleven schools were selected for pilot program on the use of Geometers Sketchpad (GSP) from them three schools were selected randomly. In each school, GPS class and traditional geometry class taught by the same teacher were the study participants. The finding of the study revealed a significance difference in the FCAT mathematics scores of students who were taught geometry using GSP compared to those who used the traditional method. It means scores of student who were taught geometry using GSP high compared to those who used traditional method.

Kumau (2012) studied on “Constraints the Use of ICT in Teaching-Learning Processes in Secondary Schools in Nyandarua South District” The purpose of this study was to investigate the use of ICT in teaching learning processes in secondary schools in Nyandarua South District and proposing the remedies which can be taken to improve use of ICT in the area. The target population of the study consisted of 21 school principals, 160 teachers and 800 from three students in all public secondary schools in Nyandarua South District. In this study stratified random sampling was used. Data was collected using questionnaires, interviews and observations. Descriptive survey design was also used since it is concerned with gathering of facts. Data collected was analyzed descriptively using chi square and Pearson’s’ product moment correlation. Descriptive statistics was also used.

The major findings showed that there were no adequate ICT facilities in most schools making it impossible to incorporate ICT in teaching and learning processes. Where ICT facilities were available there was no proper utilization of the facilities partly because of lack of staff. Most of the student seemed to engage in entertainment whenever they access computers rather than using them for academic benefits. Where facilities were available there was neither educational programs nor the internet. It was also found out that most teachers lacked basic computer training hence they need to address this problem. Based on this finding the study recommended that the government should assist schools to have electricity, train more staff in ICT and post them in schools, and also facilitate the provision of more computers in all the schools.

Nkhwalume (2013) did a research on “The Challenges of integrating ICTs into the Mathematics Curricula in the SADC Regions: The Case of Botswana”. The objective of this research is to identify the challenges that the teachers faced both at school and classroom level. There are many challenges that the teachers alluded to, but lack of access to computers, inadequate contact time for mathematics, and lack of support from administrators were major issues of concern.

Ngimi (2013) studied on “Opportunities and Challenges of Integrating ICTs in Education Delivery in the Institute of Continuing Education at the Open University of Tanzania”. The purpose of this study was to investigate the opportunities and challenges for integrating ICTs in education delivery in the Institute of Continuing Education at the Open University of Tanzania. Specifically, the study investigated lecturers’ and students’ perceptions about ICTs, competence in ICT application and access to ICTs facilities. The study used multiple holistic research design. Structured questionnaires were used to collect data from 10 lecturers in ICE and 200 students drawn randomly from five selected regional centers (Ilala, Temeke, Kinondoni, Tanga and Morogoro).

The findings revealed that there are several opportunities for successful integration of ICT in education delivery in ICE, which include positive perception of lecturers and students towards integration of ICTs in education delivery, possession of competency in basic ICTs applications and availability of access to basic ICT facilities such as computer and internet in offices, library internet cafes and at home for some of the lecturers and students. However, several challenges were identified to constrain successful integration of ICTs in ICE. These included lack of pedagogical competences by majority of lecturers, lack of ICT technical support at the institute level and access to ICTs due to inadequate infrastructure in the institute.

Sapkota (2015) did a research on "Effectiveness of information communication technology integrated pedagogy at secondary level." She conducts 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.

Shrestha (2015) did research on “Status of ICT in Teaching Learning Mathematics.” The study was case study in design. This study was based on Heartland Children’s Academy. The major tools used for the study were observation and interview. Three mathematics teacher and twenty students from class 7, 8, 9, and 10 were considering as the sample of the study. It was found from the study that there was no any plane about use of ICT in teaching learning mathematics. It was also found that there was a lack of relevant educational technology tools for schools. These tools were sometimes used for other purpose other than mathematics teaching and learning.

Nyawira (2015) studied on “Challenges Facing Teachers in Utilizing Instructional Resources When Teaching Mathematics in Public Secondary Schools in Nairobi Country, Kenya”. The purpose of this study was to find; i) the challenges facing mathematics teachers in utilizing instructional resources in teaching the subject in Nairobi County ii) the status of in-service training of mathematics teachers in Nairobi County iii) possible solutions to the challenges facing mathematics teachers in utilizing instructional resources and iv) suggestions for further research. Descriptive survey research design was adopted. The target population was 80 public secondary schools in the County. The population was sampled using stratified sampling techniques to include all categories of schools in the study and then proportionately sampled to give a sample size of 10 public secondary schools. The categories of schools included both girls and boys day and boarding schools as well as County/National schools. Five mathematics teachers were selected from each school yielding a total of 50 respondents.

Data was collected using Mathematics Teachers’ Questionnaire (MTQ). Classroom Observation Schedule (COS) was also used to investigate the types of instructional resources used and the frequency of their use. Two observations were done in every school in the sample. Form three classes were chosen because they are known to be well adjusted to their school systems. The validity and reliability of the instruments were enhanced by a pilot study. Data collected was analyzed using Statistical Package for Social Sciences (SPSS) and then presented in the form of frequency tables and percentages. The significant challenges facing teachers in utilizing instructional resources in teaching mathematics included; inadequate instructional resources, inadequate teacher professional development, heavy work load and large class sizes.

Zovko (2016) studied on “The Use of ICT in Teaching Mathematics- a Comparative Analysis of the Success of 7th Grade Primary School Students”. The purpose of this study was to examine the impact of the application of the impact of the application of ICT tools in teaching primary school mathematics. The students’ success in mathematics exam, in the linear function unit, was evaluated in two groups of 7th grade student of primary school Josip Jurai Strossmayer in Zagreb, based on their scores. The first group, 90 students, attended mathematics classes without ICT tools in teaching (school years 2008/2009 and 2009/2010). The second group, 110 students, (School years 2012/2013 and 2013/2014) attended mathematics classes with

an extensive use of ICT in teaching process. From them $48\pm 26\%$ and $58\pm 26\%$ solved linear function tests group first and second group respectively. The result of this study support the hypothesis that using ICT in teaching leads to better learning and knowledge acquisition in primary schools.

IJCDMS (2017) studied on “Identifying Barriers to integration of Technology into Traditional Approach of Learning: A Case Study of Mathematics Teachers in Former Transkei in the Eastern Cape”. The main aim of the study is to identify some of the barriers to the integration of technology into teaching mathematics in high schools. Purposeful sampling was used to survey a total of 116 high school mathematics teachers in the former Transkei Homeland. But only 97 questionnaires were used. Microsoft excel was used in the descriptive statistics. The finding of this study the willingness of the teachers to integrate technology in their day to day teaching will be affected by lack of technological skills. The study suggests that the teachers are lacking the technology knowledge to integrate technology into teaching and is one of the major reasons why these teachers are not using technology to engage the students although most students have access to internet.

Timilsena (2017) study on "Attitude of Teacher Toward ICT in Teaching Mathematics" is carried out to find the existing situation and attitude of teachers towards ICT in relation to improve student's Mathematics achievement and analyzed/explain the effect of ICT in motivating students to learn Mathematics. The result of the study showed that the schools have sufficient ICT tools with suitable existing suitable for teaching and learning.

Ghimire (2017) studied on “Problem Faced by Mathematics Teachers in Teaching Mathematics at Secondary Level”. The purpose of this study was to identify the problem faced by teachers due to school administration, teaching materials, classroom management, mathematical concept and student background characteristics and to suggest some measures for the solution of the problem. This study was descriptive and authenticated by qualitative data. The questionnaire, interview guideline and class observation from were the main tool of the study. Open questionnaire were included in each category of problems, and descriptive analysis of collected responses were carried out. Mean weightage was used for the analysis of the problem.

Research Gap

From the review of above literature, researcher found that lack of access to computer lab, lack of lesson plans, lack of staff, lack of internet, lack of computer training, inadequate contact time for mathematics, lack of administrative support, inadequate infrastructure lack of pedagogical competence, lack of ICT tools relevant to mathematics content, inadequate teacher professional development, heavy work load and large class size are the main challenges faced by teachers in using ICT in teaching. But the previous researches are different from present study with respect to place, time, and subject. So the current study has been investigated about the challenges faced by mathematics teachers in using ICT in teaching in secondary level and its possible solution to the challenges in Bara district.

Theoretical Literature Review

There are many learning theories related to teaching learning activities, such as constructivism theory, cognitivism theory, behaviorism theory and so on. In this research, researcher reviewed constructivism theory.

Constructivism Theory and Multimedia

Among student learning theories, constructivism is one of the theories to analyzed and interpret the data of mathematics on resolve the challenges. This theory encourages the student to involve themselves actively in using ICT tools in teaching learning mathematics. This theory has to analyze the solution to the challenges faced by mathematics teacher in using ICT in teaching mathematics. Constructivism will become one of the possible theories to solve the challenges on the topic of “Challenges faced by mathematics teachers in using ICT in teaching mathematics”.

The constructivism learning theory is a philosophy which believes on the new experience and productive knowledge. The founder of constructivism is Jean Piaget. This theory is used to explain how people know and what they know, which basically focuses to discover the consequences of actions through past experiences. Moreover, learners can actively participate in learning because collaboration with other is most important aspect of constructivist classroom.

With the constructivist learning, the emphasis in learning is upon the students who are active learners, seeking information and knowledge on their own, determining how to reach the desired learning outcomes themselves and not relying on teachers to supply them with information (Neo, 2003 cited by Acharya S., 2019). This theory gives more precise to learners centered idea so that teaching can more

effective when learners are involved in practical environment of constructing the knowledge. This theory effort the students and teachers to including appropriate, audio and visual tools which are considered multimodal form of modern teaching. The constructivism theory is a learning paradigm in which knowledge is considered by linking the new experience with prior knowledge. According to Crow (2005), constructivist teachers role are classified as follows:

- Present tasks with real-world application so that students can contextualize their knowledge easily.
- Give assistance so that students are able to consolidate their established understanding with their new learning.
- Provide scaffolds to bridge the gap between what learners know and what they are being presented with.
- Enable relevant experts to lead lessons when appropriate.

From the perspectives of constructivists, learners construct their own meaning through active engagement and by constructing their own representation of what they know. Learners can get results from the active participation in the learning process which starts with thinking and doing. There are lots of educational technologies which are used for teaching and learning in classroom teaching. Multimedia projector can be used to construct the knowledge with the integration of multimedia tool likes computer, audio, video and animations and it can add new approach for teaching and learning activities inside the classroom. Learners can construct the knowledge from their prior experiences in which multimedia play vital role to develop meaningful learning by motivating the learners. The use technological tool in teaching and learning has been center point of any modern era. Moreover, constructivism approach of multimedia learning supports wide range of technological tools to develop the valuable knowledge.

The use of video, audio and internet contents through the multimedia projector can engage the learners in the teaching and learning process, which can helps to create the interactive environment for student and teachers also. The teachers and students can share their idea after the audio video sessions and they may be motivated to be involved in this type of teaching learning process. Furthermore, the active participation to construct the knowledge during the interactions with the assistance of technological tools, which can brings positive achievements as compare to the

traditional types of teaching and learning method. This theory enables the students to work in team and share their idea to complete the complex problems. Therefore, this research is related to the constructivism background which believes to create the knowledge from the engagement in learning process using the tools in classroom.

This theory focused on the active participation of student in teaching learning activities where teachers as a facilitator or a guider. As our classroom are running in traditional teaching strategies where student are passive learner and teacher solve each and every problem that's why teaching learning activities become less effective. Chalk and talk method does not introduce the children needs and interest. The teachers does not apply the new knowledge and teaching strategies gain in pre-service training because of lack of sufficient knowledge, lack of necessary management and administrative support and so on. So it is also occurred as a challenge of teacher.

Social constructivism maintains that human development is socially situated and knowledge is constructed through interaction with others. Social constructivism was developed by post-revolutionary soviet Psychologist Lev Vygotsky. Vygotsky argued that all cognitive function originated in social interaction and that learning did not simply comprise the assimilation and accommodation of new knowledge by learner. He believed that knowledge is not simply constructed, it is co-constructed. In this theory zone proximal development is main way of learning. ZDP is the distance between students' ability to perform a task under adult guide.

From the literature review, researcher found that there are various challenges in using ICT in teaching mathematics. These challenges are the area of lack of staff, access computers, low speed internet, lack of basic computer training, lack of ICT technical support, access to ICTs due to inadequate infrastructure, lack of access of computers, inadequate contact time for mathematics, and lack of support from administration etc. Many researchers are conducted their research to find out challenges of teaching and learning activities but no research to find out solution for different area of challenge. So, this research focused to identify the challenge of mathematics teachers in using ICT in the area of access of technology, School administration, time and classroom management, course content and curriculum and teacher's training and also find possible solution to the challenge of different area of challenges.

Conceptual Framework

The study was focused to identify the challenges faced by mathematics teachers using ICT in teaching mathematics. From the study of related literature above, the researcher has been made the framework for this study. So the study had related to the following framework

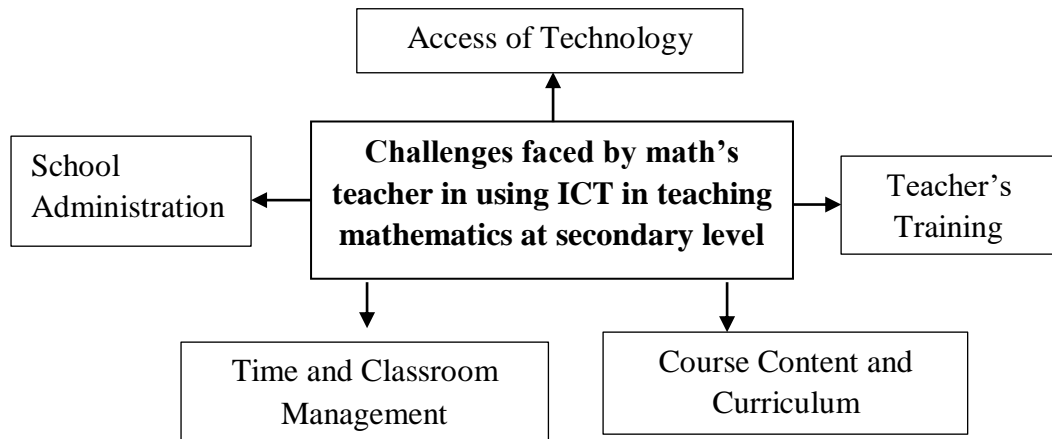


Figure No. 1

Although mathematics is a subject of interest for many schools, it is not easy to teach and learn. In this study researcher was identify challenges faced by mathematics teachers in using ICT in teaching mathematics in context of teacher's training, access of technology, school administration, time and classroom management, and course content and curriculum. For the answer of the "What are challenges?" survey was conducted and for the answer of the question "What are the possible solutions to the challenges?" interview and class observation were conducted.

CHAPTER III

Methods and Procedures

This chapter deals with the procedure of the study, which was carried out to achieve the objectives of the study. The study is sequential explanatory mixed research with systematic and analytical nature. The study was concerned with the challenges faced by mathematics teachers in using ICT in teaching mathematics at secondary level. This chapter comprises design and method of study, population, sample and sampling strategies, data collection tools and techniques, data collection procedure and process of data analysis and interpretation.

Research Design of the Study

This study was Sequential Explanatory, because the survey design to some context, and descriptive in nature by using logical and interpretation. Quantitative and qualitative approach used to collect and generate the data in the field. The quantitative methods, survey questionnaire, notion of data collection and interpretation are based on descriptive statistics to present the data in a meaningful way. In this design researcher first collect and analyzes the quantitative data and qualitative data collect in the second phase of the study. The qualitative method was used to support the quantitative data where meaning was less understood.

Population of the Study

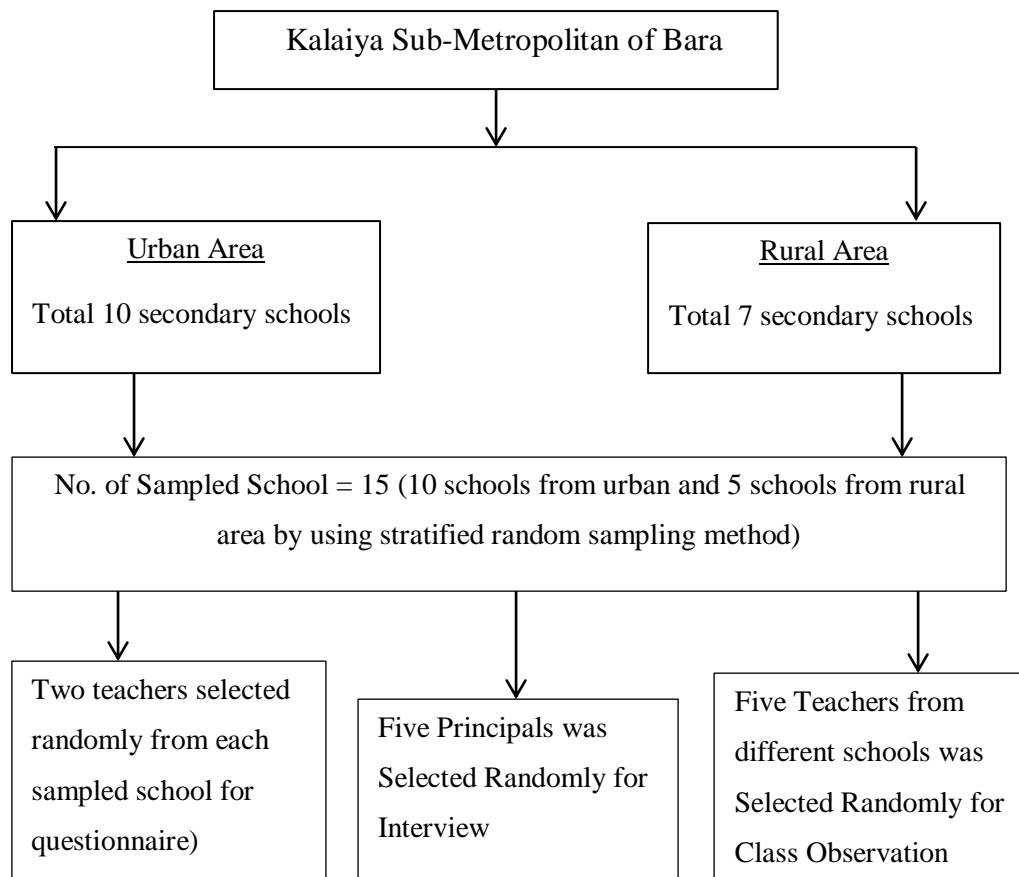
The population of this research was the entire mathematics teacher who teaches mathematics in secondary level community school of Kalaiya Sub-Metropolitan, Bara in the academic year 2075/2076. According to Kalaiya Sub-Metropolitan office of Bara there are seventeen secondary schools in Kalaiya Sub-Metropolitan.

Sample of the Study

According to Kalaiya Sub Metropolitan office of Bara, there are seventeen secondary schools. According to Ary and Razariah (1972), and Gay (1992), a sample of 10% of the population is required is considered minimum while 20% of total population is required in a survey. In this study researcher selected 88% schools out of seventeen schools i.e. fifteen schools from seventeen schools in Kalaiya Sub-Metropolitan were selected for sample by Stratified random sampling method. From those fifteen schools, thirty secondary level mathematics teachers were selected for questionnaire with two teachers from each school by random sampling method. Out of thirty teachers, five head teachers were selected for interview and five teachers

from five different schools for class observation with random sampling method.

Researcher selected sample as follows:



Data Collection Tools

Both primary and secondary data were used in this study. Secondary data were used for the understanding of past research study related to this study that were mentioned in the literature review. For the collection of primary sources of data, the researcher used the questionnaire, interview guidelines and class observation checklist.

Questionnaires

A set of printed or written questions with a choice of answers, devised for the purposes of survey or statistical study. Before developing the questionnaire, researcher consulted with mathematics expert and other mathematics teachers of the school. For this study, the questionnaire was developed by researcher himself after detailed study of related literature such as articles documents, thesis and framework of the study and with the help of supervisor. The questionnaire consisted of 25 statements followed by ranked responses in the five point of Likerts Scale. The statement of the questionnaire was constructed in such a manner that they could find

out the challenges of teacher while using ICT in teaching mathematics. The area of challenges was related to access of technology, school administration, time and classroom management, course content and curriculum, teacher's training. At end of the each section of questionnaire the researcher requested to comment on the area that is not covered by the item in the questionnaire (Appendix-II).

Interview Guideline

This tool was used for the qualitative information. After collecting the data from questionnaire, the researcher selected the teachers for interview. The non-structural questions were developed with the help of conceptual framework. Interview guidelines was constructed in a such a manner that they could find out the challenges and possible solution related to the to access of technology, school administration, time and classroom management, course content and curriculum and teacher's training (Appendix-III).

Observation Checklist

Observation is also an important tool for data collection. The researcher was observed the institutions' environment for relevant information. A check list was used when making the observation. This tool was used for the qualitative information. So the researcher was applied this tool for data collection to find out situation of using instructional plan and condition of ICT in school (Appendix-IV).

Reliability and Validity of the Tools

Reliability of tools refers to consistency of tools and validity of tools refers to appropriateness of tools. Reliability and validity of the research was made on the basis of questionnaire. So for establishment of the instruments, the numbers of statement were increased. For the validation of the tool, it was prepared on the basis of related literature, conceptual framework and verified with subject experts and supervisor. Also it was compared with the way of prepared questionnaire from related articles, published and unpublished thesis and theory of previous researches done by different research.

Scoring Procedure

For the analysis of items weightage of 1, 2, 3, 4 and 5 were assign to statement and were stated "strongly agree, agree, undecided, disagree and strongly disagree" respectively. For the statement opposing to the point of view item was taken in opposite order. Mean weightage was calculated for each statement, if calculate index

was greater than three then it was concluded that the statement was challenges. If the index measure was less than or equal to three then it is weak favor to the challenges.

Table 3.1

Meaning of Scale

S. No.	Meaning of Scale	Positive Statement	Negative Statement
1.	Strong Agree	1	5
2.	Agree	2	4
3.	Undecided	3	3
4.	Disagree	4	2
5	Strong Disagree	5	1

Data Collection Procedures

For data collection, the researcher visited each of the sampled school along with questionnaire, observation checklists, interview schedule and request letter from T.U. to render any help needed to the research form the school administration. The researcher was presented a request each of the sampled teachers of the school to fulfill the questionnaire honestly. Researcher explained and clarifies any confusion that arose in understanding the statements. After collecting questionnaire, researcher were categorized the information on tabular form. Furthermore the researcher thanked teacher and principal of the school. The interview was conducted to the selected sample principal of school by using interview guidelines. The researcher also observed the mathematics classes five times to each from selected five teachers.

Data Analysis and Interpretation

After collecting data, the researcher analyzed and interpreted using both quantitative and qualitative methods. The researcher used five point Likert Scales as a statistical tool for the analysis of questionnaires. Mean weightage was used to find whether a statement is shows challenge or not and qualitative theme were interpreted in the more descriptive way on the basis of quantitative result.

The obtained data were analyzed and interpreted with the help of following statistical technique:

$$\text{Weighted Mean} = \frac{\text{Total Rank Score of a statement}}{\text{Number of Teacher's Responses}}$$

Mean weightage was used to locate the central position of the responses to the statements of teacher as a whole in the rating scale. Each statement was studied in term of whether the teacher challenges are up to the index or not. If the calculated

index is greater than 3 then it is concluded that the statement indicates the challenges and it is strongly favorable to it. If the mean weightage is less than or equal to 3 then it is less favorable to the challenges.

Next, the data collected through interview schedule and observation checklist were analyzed and interpreted on the basis of the framework that researcher developed in the review of the related literature section. These are themes for my study. The researcher tried to interconnect with previous finding and the way of analysis in the similar content. The data triangulation would be way of interpreting information collect from tools. The qualitative data obtained from the interview guidelines and class observation checklist. The validity and reliability of this study were maintained through cross matching and triangulation method.

CHAPTER IV

Analysis and Interpretation of Data

The data for this study were collected from thirty secondary level mathematics teachers in Kalaiya Sub Metropolitan of Bara district. The collected data were tabulated and analyzed according to the objective of the study. The obtained data were statistically analyzed and interpreted by using statistical tool: mean weightage. Also the data obtained from interview guideline and observation checklist were analyzed in descriptive way. The data were analyzed item wise in the various challenges related to teachers who used ICT in teaching mathematics at secondary level.

The whole data categorized in to five groups. These groups are, access of technology, administrative support, time and classroom management, course content and curriculum, teacher's training. Thus the collected information were analyzed and discussed under the following topic:-

- Challenges related to access of technology
- Challenges related to administrative support
- Challenges related to time and classroom management
- Challenges related to course content and curriculum
- Challenges related to teacher's training

Challenges Related to Access of Technology

Access of technology is an important part of meaningful ICT based teaching and learning process. In classroom activity teachers and students have vital role for the use of technology. The most basic step toward effective technology integration is widespread access to equipment necessary to run educational computer program. Many students do not have regular and reliable access to a computer. Inconsistent computer access makes it extremely difficult for instructors to integrate technology into existing lesson plans. Routine access to hardware (i.e., laptop, computer or tablets), software (e.g., reading and writing software, internet browsers), and internet connection is fundamental requirements.

Table 4.1
Challenges Related to Access of Technology

S.N.	Statements	Mean Weightage
1.	Poor internet connection.	3.7
2.	Lack of sufficient Computer and ICT tools in school and home.	3.36
3.	Internet facilities are limited to only administrative work.	3.83
4.	Most parents not in favor of using ICT in school.	2.53

From the above table 4.1, the researcher was found that the weightage mean of the statement “Poor internet connection” is 3.7 which signify the challenges. The mean weightage of the response to the statement, Lack of sufficient Computer and ICT tools in school and home is 3.36 which is greater than three thus that indicate the challenge. Most of teachers are accepted that internet facilities are limited to only administrative work. The mean weightage of this statement is 3.83 which is a challenge. The statement, “Most parents not in favor of using ICT in school.” is not challenging. The average response to this statement is 2.53.

After summarizing the questionnaire, the researcher came to know that all the teachers were facing challenge to the above statements. Beside this some challenge were strongly faced by all teachers. To find out detail information about those challenge, the researcher carried in-depth study by using interview. Interview was administrated to get opinion of sampled principals on challenges. Principal with regard to the challenge about access of technology stated as:-

‘There is no sufficient computer and strong internet access in our school; otherwise we would use it in teaching activities. Most of the students in our school come from poor families so they are not able to buy computer and internet. In our school internet facilities are limited to only administrative work because students and teachers use the internet unnecessarily, which makes the internet work very slowly’ (Principal 1).

The above views of teacher indicate that there is a limited number of computer and poor network connection and therefore internet facilities are limited to only

administrative work. It is also indicate that there is a limited accessibility of students and teachers in using computer and internet.

The above reality was found by observing their classes. Some episodes of their observed classes are as follows:

Episode One

“One day teacher entered into the classroom with daily using materials such as marker, duster, textbook and HW copies of the students. All students stood up and said good morning sir as it was second period, and teacher also told good morning everyone and seat down everyone and have your seat please. He wrote the topic Equations on the white board and then teacher discussed with students about general idea of simultaneous equation. He wrote the definition of simultaneous equation. After that some students were asking about what is equation? And teacher thinks within a few second and pulled out his mobile phone from his pocket and searched on the internet but could not find it due to weak internet. Then teacher replied ‘it is not necessary for your SEE exam so you have to recite.’ Then the teacher taught it by giving different examples. But he does not use ICT tools and internet even if such materials were available in the school. He solved the some problems and allowed student to do the remaining problems of textbook. Teacher helped the students on solving problems for some time then he went out. After five minutes, he came to the class and informed students to do remaining questions, summarized the class and gave homework.”

From the above observed class, it is found that the teachers were not using available ICT tools and instructional materials. He just use lecture method. It was also seen that teachers were teaching their class without lesson plan. It is also seen that there was a weak internet connection.

Regarding above problem, teacher responded that ‘We have only geometry box and daily using materials as teaching materials for teaching mathematics. Some mathematical charts are available in our school for primary level. We are not allowed to using audio-visual materials and ICT tools because all facilities are limited to administrative work. We do not have such facilities’ (Teacher A)

The above mathematics teachers’ view cleared that there was no sufficient mathematical teaching aids. It was also seen that there was lack of sufficient ICT tools

and strong internet connection in school due to lack of additional income source and financial crisis of school, school administration could not add required teaching materials also. Moreover, there was no protection for available teaching materials because there was no separate room to keep instructional materials, such materials kept in office room or staff room haphazardly as well as there was no provision for repairing the damaged materials.

For the solution of above mentioned challenge related to access of technology teachers are responded as:-

‘School administration should manage the strong internet and necessary ICT equipment for teacher and student and create digital environment in school. Government of Nepal should supply the essential and necessary ICT tools as well as should encourage the school administration to purchase and manage ICT’s equipment’ (Teacher A)

From the teacher’s response, interview and the class observation, the researcher concludes internet facilities are limited to only administrative work because of limited accessibility and weak network connection. Also there is lack of sufficient ICT tools. But the experienced teacher who has been trained was not applying their ICT skills and knowledge gained in training because of unavailability of sufficient ICT tools and strong internet connection. So government of Nepal should supply the essential and necessary ICT tools as well as should encourage the school administration to purchase and manage ICT’s equipment, frequent short time training as well as ICT training should be organized for teachers for their better professional development.

Challenges related to School Administration

School administration is responsible for all activities that take place in the school. It plays a vital role in construction and purchase of ICT’s tools and teaching materials, managing time to construct lesson plan, and many more. For the understanding of challenges related to school administration, researcher raised five questions. Those questions and their mean weightage are given below:

Table 4.2
Challenges Related to School Administration

S.N.	Statements	Mean Weightage
1.	The administration often supports economically and physically to construction and purchase ICT's tools.	3.63
2.	The administration has provided me sufficient leisure period to construct lesson plan.	3.7
3.	Lack of technical support.	3.67
4.	Lack of facilities and award for good performance.	2.47
5.	Lack of refreshment training to teach difficult and rigor topic.	3.8

From above table 4.2, the administration often supports economically and physically to construction and purchase ICT's tools. The finding of the research supports this statement. Mean weightage response of this statement was found to be 3.63. The mean score of the response to the statement, the administration has provided me sufficient leisure period to construct lesson plan is 3.7 which is greater than three thus that indicate the challenge. The mean score of the response to the statement, Lack of technical support is 3.67 which are greater than three thus that indicate the challenge. From this field study it was found that lack of facilities and award for good performance is not a challenge for teachers because the mean weightage of the statement is 2.47. The mean score of the response to the statement, Lack of refreshment training to teach difficult and rigor topic is 3.8 which is greater than three thus that indicate the challenge.

After summarizing the questionnaire, the researcher came to know that all the teachers were facing challenge to the above statements. Beside this some challenge were strongly faced by all teachers. To find out detail information about those challenge, the researcher carried in-depth study by using interview. Interview was administrated to get opinion of sampled principals on challenges. Principal with regard to the challenge about school administration stated as:-

'All the facilities of school depend on the economic status of the school but we are suffering from financial crises. Our school has no additional source of income. In future, we are hoping to get financial support from Kalaiya Sub Metropolitan of Bara

to buy and construct ICT's tools. In our school we have to take six periods out of seven or eight period. We can't take rest in leisure period because of we have to check homework in those period instead. We can't provide technical support in time because we have not any technical staff' (Principal 2)

The above views of teacher indicate that there is a lack of economical sources in the school and therefore the school administration cannot provide any economic support to teacher for construction and purchase of ICT's tools. The aim of school administration is to manage such challenges with the help of donors. Also teachers cleared that teachers were not getting sufficient leisure period to construct lesson plan. Therefore it is conclude that not getting sufficient leisure periods and technical support is also the challenges faced by mathematics teachers in using ICT.

For the solution of above mention problem related to school administration principals were responded as:

'Schools need to establish ICTs math lab with strong internet connection. So both government and non- government organization should help to facilitate skill man power, stabilized electricity supply, hardware resources and software resources to enhance the use of ICT in government schools'. (Teacher B)

'Schools should be provide sufficient time for teachers to construct effective lesson plane' (Teacher C)

According to Vygotsky (1978), learners conduct their knowledge on the basis of interaction with environment. For making school environment good, school administration is responsible to the students, teachers, parents and society. According to social constructivism, society is main sources of learning. The school administration has major role of maintaining good environment by providing physical resource, instructional material (including ICT's tools), appropriate time, technical support and refreshment training. If the school administration became weak and irresponsible then learning environment deteriorate and we cannot expect good result.

From the teacher's response, interview and theme of the theory researcher concluded that school administration should be responsible to supports economically and physically to construction and purchase ICT's tools. Also school administration should provide appropriate time to construct lesson plan and complete the course in

time, teacher should use lesson plan with appropriate method and materials. School administration should be managed technical staff.

Challenge relate to Time and Classroom Management

Table 4.3

Challenges Related to Time and Classroom Management

S.N.	Statement	Mean Weightage
1.	There is no separate ICT's math lab.	4.2
2.	Negative attitude and belief of teacher's toward ICT.	2.33
3.	There is no proper space in classroom to demonstrate Instructional materials.	2.7
4.	Hardware and software problems often disturb the lesson.	3.63
5.	Time period of lesson is sufficient to teach the lesson by using ICT tools.	3.6
6.	Passive participation of students in ICT based classroom.	3.43

Above table 4.3 shows that for teaching mathematics, there are no separate ICT's math labs. The weightage mean of the response of teacher for this statement is 4.2 which signify the challenge. Most of the teachers disagree to the statement; Negative attitude of teacher's toward ICT. The mean weightage of the response for this statement is 2.33, which doesn't signify challenge. Also most of teachers are disagree with the statement. There is no proper space in classroom to demonstrate Instructional materials. Average response to this statement is 2.7, which doesn't signify the challenge.

Most of teachers agree with the statement hardware and software problems often disturb the lesson. Mean weightage of this statement is 3.63, which signify the challenge. The mean score of the response to the statement, time period of lesson is sufficient to teach the lesson by using ICT tools is 3.6 which is greater than three thus that indicate the challenge. The statement "Passive participation of students in ICT based classroom" is challenging. Average response to the statement is 3.25.

After summarizing the questionnaire, the researcher came to know that all the teachers were facing challenge to the above statements. Beside this some challenge were strongly faced by all teachers. To find out detail information about those challenge, the researcher carried in-depth study by using interview. Interview was

administrated to get opinion of sampled principals on challenges. Principal with regard to the challenge about time and classroom management stated as:-

‘We have only computer lab. We have no separate room for math lab. If it is available here in our school, then I would use it in teaching learning activities. Hardware and software problems often disturb the lesson so it is difficult to teach a lesson over a period of time. Student participation on classroom activity plays a vital role for educational achievement. So students should active in classroom activity. But students are inactive in the ICT based class room. Even the students are inactive and they are not interested in learning mathematics’ (Principal 3)

The above views of teacher indicate that there is a lack of separate math lab and lack of appropriate time to complete the course in time. Student participation play vital role in education achievement so teacher suggested that student should to be active in classroom for learning. The reality was found by observing their classes. Some episodes of their observed classes are as follows:

Episode Two

By observing the class, the observer found that, “One day a mathematics teacher of one of the sampled teacher entered into the classroom with projector and laptop. Then he connects the projector and laptop with electricity after that he open the projector and laptop. In this activities teacher spend 10 minute. After this, he open the power point and Geogebra file and started to teach the topic ‘Theorem: In a circle, the inscribed angle is half of the central angle standing on the same arc.’ Step by step. After ten minutes electricity was disconnect and therefore class disturb up to five minutes. After this, teacher said angrily, “That’s why I don’t want to use ICT in the classroom. It is useless to use ICT in classroom” and he cleared the white board with duster and started to teach same theorem in the fast way. Finally he completed the theorem and same time the school bell rang.”

The above observation shows that the teachers are not using student centered teaching methods. Also there is a lack of participatory approach for both student and teachers because the teacher proved the theorem himself without involving the students. It is also shows that they have negative belief toward ICT. There is also lack of ICTs math lab, technical support, and appropriate time. It was also seen that teachers were teaching their class without any pre-plan, that’s they could not summarize and complete the class in time.

Regarding above problem, teacher responded that 'I have always had a good attitude towards the use of ICT so I want to use ICT in the classroom. But we do not using ICT based materials because we do not have such facilities like as technical staff, electricity generator and separate ICT's math lab. Also there is the lack of protection of teaching materials' (Teacher C)

The above mathematics teachers' view cleared that there were lack of technical staff, electricity's generator and separate math lab. Due to the lack of these facilities, the teachers were not able to present the teaching and learning activities effectively and class was disturbed within five minutes. And there is find a contradiction between teachers' view and reality found by observing the class. Attitude and belief of teachers toward use of ICT in classroom was negative.

For the solution of above mention challenge related to time and classroom management teachers are respond as:-

"Students are main body of learning activities. So, students should active in classroom activities. Also teachers should use student centered method on which student are actively participated for this school administration create digital environment. For this government of Nepal should supply the essential and necessary ICT tools as well as should encourage the school administration to purchase and manage ICT's equipment. Schools need to establish ICT's math lab and teacher should use lesson plan with appropriate method and materials properly. Attitude of teachers should be positive toward use of ICT. School administration should manage technical manpower to solve technical problems' (Teacher C)

Constructivism theory focused on the active participation of student in teaching learning activities where teacher is as a facilitator or a guider. Our classrooms are running in traditional teaching strategies where student are passive learner. And teachers solve each and every problem of mathematics with lecture method, that's why teaching learning activities become less effective. So, this theory focused on the active participation of student in learning. Teacher should teach according to student's interest. According to Piaget's knowledge is not passively received rather knowledge by student. The use of video, audio and internet contents through the multimedia projector can engage the learners in the teaching and learning process, which can helps to create the interactive environment for student and teachers also.

From the teacher's response, interview, class observation and theme of the theory, the researcher concluded that students were actively participated in teaching activities then the learning is meaningful. For student participation teacher should use ICT's tools on which students are actively participated. He researcher also found that there is lack of technical support, separate ICT math lab then hardware and software always disturb the lesson. There is an also lack of appropriate time and active participation of student. For this challenge school administration should be responsible to manage separate ICT math lab with technical staff. Also school administration should be providing appropriate time to construct or prepare lesson plan. Teachers should be use child centered teaching method for active participation of the students. There are found negative attitude toward ICT so school administration should provide ICT based refreshment training to change attitude of teachers toward ICT.

Challenges related to course content and curriculum

Table 4.4

Challenges Related to Course Content and Curriculum

S.N.	Statement	Mean Weightage
1.	It is easy to complete the course in time by using ICT tools in teaching activities.	3.4
2.	Inability to make a link between ICT tools and the curriculum.	3.4
3.	Unavailability of Software Relevant to Mathematical Content and Curriculum	3.53
4.	Some contents are difficult to teach by using mathematical software.	3.33
5.	Lack of teacher involvement in curriculum planning.	3.5

From the above table 4.4 most of the teachers disagree to the statement it is easy to complete the course in time by using ICT in teaching mathematics. The average response to this statement is 3.4 which is greater than three thus that indicate the challenge. In this regards, the head teacher responded as:

“It is true that use of ICTs is necessary for meaningful learning but ICT's tools cannot be used frequently in classroom because there are almost seventy-eighty

students in the classroom and it gets disturbed for some time. Next classes cannot be run regularly due to different strikes. It is more necessary to complete the course in time than to use ICT in the classroom because we have to follow the rules and regulation made by Education Development and Coordination Unit (EDCU) of Bara. If there is a problem in completing the course in time by using ICT then, how we can use ICT in classroom?’ (Principal 4)

From above view of head teachers, it concluded that teachers were facing challenges in using ICT in the classroom. There was pressure upon teachers to complete the whole course in time from EDCU and they gave more priority to complete the whole course in time than to use ICT in the classroom. Though the teachers wanted to use ICT, they were not using ICT in the classroom. It was not their wish, but it was their compulsion.

The mean score of the response to the statement, Inability to make a link between ICT tools and the curriculum is 3.4 which is also greater than three thus that indicate the challenge. The statement, “Unavailability of software relevant to mathematical content and curriculum” is challenging. Mean weightage of the statement is 3.53. From this research it was found that some contents are difficult to teach by using mathematical software. Mean weightage for this statement is 3.3 which is a challenge. The statement “Lack of teacher involvement in curriculum planning” is challenging. Average response to the statement is 3.5. In this regards, the head teacher responded as:

‘Good curriculum plays an important role in forging life-long learning competencies, social attitudes and skills such as tolerance and respect, peaceful conflict management, promotion and respect of human rights, gender equality and social justice. Teachers know their students better than others involved in curriculum process and teachers can provide insight into the types of materials, activities, and specific skills that need to be included in curriculum therefore teachers must be involved in curriculum planning. But there is no any provision to get chance in curriculum planning. Therefore teachers are facing difficulty to find the relevant ICT tools and link between ICT tools and mathematical content’ (Principal 4)

The above views of teacher indicate that there is a lack of involvement of teachers in curriculum planning and it is also indicate that there is a lack of ICT tool relevant to mathematical content.

For the solution of above mention challenge related to time and classroom management principals are respond as:-

‘Curriculum Development Center (CDC) should be involved mathematics teachers to develop mathematics curriculum. School administration should be conduct refreshment training based on need and demand of mathematics teachers and mathematics teachers should be participate. And teachers should be applying their skills and knowledge gained from training in real classroom’ (Teacher D)

The curriculum is a heart of education, the sharing of learning experience between the teacher and learner. All else in the system should be derived from this: how learners should assessed, how teachers should be trained and develop, what textbook and other learning support materials should be like, how schools and the educational system should be organized and managed, and the allocation of resources necessary for the system to function. According to (Wilson, 1996), in a constructivist design of curriculum, learners and teachers participate in the design of process as characteristic of design.

From the teacher’s response, interview and theme of the theory researcher conclude that mathematics teachers should be involved in development of curriculum because it provides idea about, how learners should assessed, how teachers should be trained and develop, what textbook and other learning support materials should be like, how schools and the educational system should be organized and managed, and the allocation of resources necessary for the system to function. It helps the teacher to identify teaching material/ICT tools relevant with mathematical content and link between curriculum and ICT tools. School administration should be provided sufficient time and appropriate ICT software related to mathematical content. Teachers should be used their skills in multimedia classroom.

Challenges Related to Teacher’s Training

In the sampled schools, all the teachers related with mathematical background. Out of 30 teachers, 28 teachers passed bachelor degree in mathematics education. It was showed that they are trained and experienced in teaching process. Especially the experienced teachers who trained were not applying their ICT’s skills, knowledge gained in training in classroom teaching. Application of training skill in real classroom situation is important aspect of teaching. If there was not transformed the training skills (ICT’s skill) then teaching activities became traditional and boredom.

For understanding the challenges related to teacher training, the researcher raised four questions. The researcher try to elaborate the following in detail related to the teacher training.

Table 4.5

Challenges Related to Teacher's Training

S.N.	Statements	Mean Weightage
1.	Training is not based on need and demand. It is only for formality and upgrading.	3.6
2.	There is no any training schedule to improve teaching learning activities in our school.	3.47
3.	The trainers are not very good at content to deliver the training.	2.47
4.	Trainers are not well experienced and skillful in the use of ICT to deliver the training.	3.8
5.	I deliver the knowledge and teaching strategies in ICT based classroom whatever I have learned in the training program.	2.5

From the table 4.5, teacher training is not based on need and demand of teacher. It is only for formality and upgrading. The finding of the research supports this statement. Mean weightage response of this statement was found to be 3.6. Most of teachers agreed that there is no any training schedule to improve teaching learning activities in his school. The average response to this statement is 3.47 which is greater than three thus that indicate the challenge.

Most of teachers disagreed that trainers are not very good at content to deliver the training. The average response to this statement is 2.47 which does not signify the challenge. The statement, "Trainers are well experienced and skillful in the use of ICT to deliver the training" is challenging. Average response to this statement is 3.8. It means trainers are not well experienced and skillful in the use of ICT to deliver the training. The mean weightage of the response to the statement, I deliver the knowledge and teaching strategies in ICT based classroom whatever I have learned in the training program is 2.5 which is does not signify the challenge.

After summarizing the questionnaire, the researcher came to know that all the teachers were facing challenge to the above statements. Beside this some challenge were strongly faced by all teachers. To find out detail information about those

challenge, the researcher carried in-depth study by using interview. Interview was administrated to get opinion of sampled principals on challenges. Principal with regard to the challenge about access of technology stated as:-

'Sufficient ICT's tools are not available in school for gaining knowledge in training. Teachers training are not based on need and demand of teacher that are only for formality. Refresher training to teach difficult and rigor topic are not conduct in school. Trainers are very good at content but they are not well experienced and skillful in the use of ICT to deliver the training. The trainer uses whiteboard, marker, cardboard paper and colour pen only to deliver the training' (principal 5)

The above teachers' view cleared that the trainers were not skillful like in use of ICT while delivering, that's why they were not using ICT: Laptop, overhead projector, related software and many more to deliver the training in interesting, meaningful and purposive way. Most of trainings are not based on need and demand. It is only for formality and upgrading.

Application of training skills in real classroom teaching /situation is the most important aspect of the study/training. If there is not transfer of training skills the investment of time, money and labor will be useless and there would be question mark behind the whole package. Researcher observed the trained mathematics teachers' classroom and found as follows:

Episode Three

"One day, the mathematics teacher entered into classroom with the daily using and other limited teaching materials which were related to the topics. Teacher left the teaching materials in front of the students' desk and reviewed the previous lesson. He wrote the topic of that day 'area and volume of circular cone'. He described about circular cone with solid figures. He just wrote the formulae of curved surface area, total surface area and volume with geometrical figures. Then he let the students to solve the related problems by using given formulae. Students were asking about how the formulae can be developed but teacher replied 'a formula is a formula so you have to recite.' Then he checked students' copies and guided to their mistakes. Finally he summarized the topic and gave homework.

From this observation, it is seen that trained teachers were also not implementing their skills in the real classroom appropriately. In the observed school,

there were some paper made materials related to this topic and ICT lab but the teacher did not use ICT tools and paper made materials. If he used those ICT's materials then it would be easier to make students clear about curved surface area, total surface area, and volume of cone. The place of placing presentation and summarization skill of instructional skill of instructional materials gained in training session were not also found to be transferred in the real classroom.

According to the teachers, they were not getting participation in such training which was related to ICT. Instead the training was conducted on the topic such as physical hazard like earthquake which could occur accidentally. Also they never receive fruitful feedback from the resource person and from the school supervisor. Moreover, they stated that they would try to make their teaching effective and meaningful through the teacher training.

For the solution of above mentioned problems related to teacher training, teachers are responded as:-

“School administration should provide necessary equipment (Including ICT equipment) for teachers and students. It should provide the refreshment ICT based training to teach rigor topic and use ICT's properly. Supervisor and resource person should give positive feedback and suggestion.

Constructivist theory stated that teacher is a facilitator or a guider. Teaching is skillful job. So the teachers have needed the different ability and capacity to fulfill the need of the learners. So teacher training is essential for their profession to develop ICT skills. According to Mcleod (2013) in constructivism teacher is scaffolder. And zone of proximal development (ZPD) is the main way of learning. For increase ZPD teachers play the important role to guide the students. In constructivist, ICT based classroom instruction is active, student centered based. So teachers need refreshment training to understand the method and skills about ICT to teach the student by using ICT's tools.

From the teacher's response, interview, class observation and theme of the theory, researcher concluded that teaching is skillful job so teachers have needed the different capacity and ability about ICT to fulfill the needs of the learners. So training is essential for their profession to develop skill about ICT. But the experienced teachers who have trained were not applying their skill and knowledge gain in the training because of unavailability of sufficient ICT tool and material to use trained knowledge in classroom activities. Also it is necessary to conduct refreshment

training time to time. School administration should be responsible to teachers, students and parents. Short term refreshment training should conduct by administration for the teacher to teach rigor and difficult topic it surely positively affects in learning environment. Training center should provide well experienced and skillful trainer in the use of ICT to deliver the training. Teachers should apply their ICT skills and knowledge in classroom.

CHAPTER V

Summary, Finding, Conclusion and Recommendation

This chapter deals with result of study. This chapter is divided into four section they are summary, findings, conclusion and recommendation. In each section the detail is given according to the analysis and by the help of findings which are described in chapter four of this study.

Summary of the study

The purpose of the study was to identify the challenges faced by mathematics teachers in using ICT in teaching mathematics and to explore the possible solution to the challenges faced by teachers in using ICT in teaching mathematics at secondary level.

The specific objective of this study were to identify the challenges related to access of technology, to identify the challenges related to school Administration, to identify the challenges related to time and classroom management, to identify the challenges related to course, content and curriculum, to identify the challenges related to teacher's training and to explore the possible solution for these challenges.

For this study the challenges were categorized into five different areas. The sequential explanatory method was used to conduct the study. The researcher himself develop the questionnaire under the guidance of supervisor consisting of twenty five items related to various challenges faced by the secondary mathematics teachers while using ICT in teaching activities. The questionnaire, interview guideline and classroom observation were tools of the study.

The responses were collected from different sample teachers using stratified sampling method. The data collected from questionnaire were quantified based on Likert five point scale. Open questionnaire were included in each category of challenges, and descriptive analysis of collected responses were carried out. As statistical indicator, mean weightage was used for the analysis and such analysis was authenticated by qualitative data obtained by class observation form an interview schedule. From the field survey and statistical analysis of the collected data authenticated by qualitative data, it was found that teachers had been facing a number of challenges in using ICT in teaching mathematics at secondary level.

Finding

On the basis of analysis and interpretation of the data, the major findings of this study are presented below:

- Because of limited accessibility and network connection, internet facilities are limited to only administrative work.
- There is lack of technical support in school.
- Teachers are not getting sufficient leisure period to construct teaching material.
- It is more necessary to complete the course in time than to use ICT in classroom because teachers have to follow the rules and regulation made by DEO.
- Schools do not have any provision to construct and purchase required ICT's tools.
- School Administration irresponsible to provide the necessary ICT's equipment for teachers and student. There is no any provision of separate math lab.
- Most of schools have no any proper schedule for refreshing training to deal with new challenges that take place during teaching learning activities. Moreover they are not participating in ICT training although they want to do so.
- Technical problem often disturb the class.
- Students are not laborious to learning mathematics and they don't actively participate in ICT based classroom.
- Because of unavailability of software relevant to mathematical content and curriculum, there is problem on teaching mathematics.
- Teachers are not able to make links between ICT's tools and curriculum.
- The training provided for the teachers are not based on need and demand of teacher. They are providing only for formality and upgrading. On other hand, there is less refreshment training are conducted on mathematics.
- Trainers are good at content but poor in the use of ICT and still they are delivering the training in traditional way.
- Most of teachers aren't applying their skills about ICT and knowledge, which are provided by the training in classroom. Moreover, there are not sufficient materials available in school.

Conclusion

From the above stated findings of the study, it can be concluded that teaching learning activities of mathematics by using ICT is not satisfactory in Kalaiya Sub Metropolitan, Bara district. Most of the teachers in Kalaiya Sub Metropolitan, Bara district are facing a number of challenges due to the access of technology, school administration, time and classroom management, course content and curriculum and teacher's training.

Moreover, it found that internet facilities are limited to only administrative work because there are limited accessibility and network connection. On the other hand hardware and software problem often disturb the lesson because of lack of technical support. School Administration is irresponsible to provide the necessary ICT's equipment for teachers and student, inappropriate school environment and pressure in the sense that course must be completed in time at any cost, Lack of proper ICT's equipment, Lack of time, unavailability of ICT's math lab, inactiveness of student in ICT based classroom, Lack of ICT training for teachers, lack of refreshment training, inability to make a link between ICT tools and the curriculum, lack of teacher involvement in curriculum planning, lack of well experienced and skillful trainer in the use of ICT to deliver the training etc. are some of the burning challenges of the teacher in using ICT in teaching mathematics.

For solving the above mention challenges refreshment training should be conducted time to time, school administration should manage the strong internet and necessary ICT equipment for teacher and student and create digital environment in school, teacher should be used available ICT tools properly, Government of Nepal should supply the essential and necessary ICT tools as well as should encourage the school administration to purchase and manage ICT's equipment, frequent short time training as well as ICT training should be organized for teachers for their better professional development, school administration should provide appropriate time to construct lesson plan and complete the course in time, teacher should use lesson plan with appropriate method and materials.

Recommendation for Educational Implication

The researcher makes the following recommendations for educational implication.

For the Teachers

ICT helps teachers to interact with student. When ICT is integrated into lessons, students became more engaged in their work. This is because technology provides different opportunities to make it more fun and enjoyable in terms of teaching the same things in different ways. But teachers face many challenges when using ICT in classroom. In such cases teachers have to find solution to such challenges. In this research researcher suggests some possible solution to challenges related to access of technology, school administration, time and classroom management, course content and curriculum and teacher's training. So mathematics teachers can be uses this study to find possible solution to challenges and effective teaching using ICT.

For the Principals

Based on the research finding, the teachers' challenges and its possible solutions are not always consistent. Most of teachers do not understand the implementation of ICTs. In addition, the existence of principal's roles to control and supervise how the mathematics teachers at their own school conduct mathematics class must be guided regularly. The researcher suggests the principal to manage ICTs' infrastructure and do some refreshment training or workshop about use of ICT in teaching mathematics for the mathematics teachers to assist the teachers in implementing ICT based teaching appropriately. So, the mathematics teachers can improve their ability in using ICTs. It can also increase the students' ability in mathematics because they get good technology based teaching. In the end, the schools can get good name and reputation.

For leaders

The result of this study could be used by provisional and national leaders in Nepal to facilitate the development of policies related to ICT implementation and teacher training.

Recommendations for further Improvement

Recommendations have been made to improve the teaching situation on the basis of findings and conclusions. Researcher would like to recommend as follows.

- Schools need to establish ICTs math lab with strong internet connection.

- Teachers should be good at the use of ICT.
- A research center level as well as district level exhibition of teaching materials should be conducted.
- Training center should provide experience and skilled trainer for conducting ICT based training.
- Teachers should be applying their skills and knowledge gained from training in real classroom.
- Teachers should be use ICT in classroom properly.
- Head teachers should encourage the teachers and student to use ICT.
- Training should be providing based on need and demand of teachers.
- School administration should reward for good performance of the teacher.
- Policy makers should make certain that ICT policy statements are practical and easily convertible into reality.
- The level of literacy in ICT should be enhanced by creating awareness the media and by developing positive attitude towards the application of ICT in government school.
- The government schools should be provided with necessary funds for proper financing and maintenance of ICT related appliances.
- The government should make the teaching of ICT as free and compulsory part of the curriculum to massively increase the number of ICT experts in the nation.
- Both government and non- government organization should help to facilitate skill man power, stabilized electricity supply, hardware resources and software resources to enhance the use of ICT in government schools

Recommendation for the further study

The researcher has made following recommendation for further study:

- Similar study can be conducted on the challenges faced by basic level.
- Similar study can be carried out with large sample size and various school of different part of Nepal.
- Some study related to compare the challenges between Terai regional and Himali regional teachers in using ICT in teaching Mathematics.

- Some study related to comparative study of challenges faced by male and female teachers in using ICT in teaching mathematics.

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Appendices

Appendix-I

Name of Sampled School

Urban Area

S.N.	School's Name	Location
1.	Shree Nepal Rastriya H. S. S.	Kalaiya
2.	Shree 3 Chandra S. S.	Kalaiya
3.	Shideshwar S. S. S	Kalaiya
4.	Panna Devi Kanya H. S. S	Kalaiya
5.	Janta S. S.	Bhawanipur, Kalaiya
6.	Durga H. S. S	Barewa
7.	Nepal Rastriya S.S.	Motishar
8.	Nepal Rastriya S.S	Sisahaniya
9.	Nepal Rastriya H. S. S.	Manaharwa
10.	Nepal Rastriya S.S	Siswa Maheshpur

Rural Area

1.	Mahabir Nepal Rastriya S.S.	Brahampuri
2.	Amar H.S.S.	Majhauriya-2
3.	Nepal Rastriya S.S.	Dharmanagar-5
4.	Nepal Rastriya S.S.	Rampur Khesraha
5.	Tapi H. S. S.	

Appendix-II
Questionnaire

Respected Teachers,

I am masters' degree student of Mathematics Education, Central Department of Education, Kirtipur, Kathmandu. I am writing a thesis entitled on "Challenges faced by mathematics teachers in using ICT in teaching mathematics" as a partial fulfillment of the degree graduation. ICT based teaching learning activities couldn't be effective without identifying the actual challenges within it as well as challenges faced by teacher in using ICT in teaching. So to complete this thesis, I have prepared some questions for you. Researcher is very much thankful for your valuable help and would like to express gratitude to you and your institution. The information obtained from you is used for this study and your answer is kept secret.

Researcher

Dilip Sah Lahera

Department of Mathematics Education

Section A

Teacher's bio-data

Name: Qualification:

Age: Sex:

Teaching Experience: Training:

Schools Name:

Location:

Section B

This is humble request to you to read each of statements described in questionnaire carefully and express honestly your opinion by putting tick mark (√) at the appropriate space where SA = Strongly Agree; A = Agree; U = Undecided; DA = Disagree and SDA = Strongly Disagree.

S.N.	Statements	Responses of the Teachers					Weighted Mean
		SA	A	U	D	SDA	
A	Access of Technology						
1.	Poor internet connection	12	8	2	5	3	3.7
2.	Lack of sufficient computer and ICT tools.	9	10	0	5	6	3.36
3.	Internet facilities are limited to only administrative work.	15	6	2	3	4	3.83
4.	Most parents not in favor of using ICT in school.	5	4	3	8	10	2.53
B	School Administration						
5.	The administration often supports economically and physically to construction and purchase ICT's tools.	0	5	6	14	5	3.63
6.	The administration has provided me sufficient leisure period to construct lesson plan.	2	5	2	12	9	3.7

7.	Lack of technical support	11	10	0	6	3	3.67
8.	Lack of facilities and award for good performance.	5	3	2	11	9	2.47
9.	Lack of refreshment training to teach difficult and rigor topic.	12	9	2	5	2	3.8
C	Time and classroom management						
10.	There is no separate ICT's math lab.	20	5	0	1	4	4.2
11.	Negative attitude of teacher's toward ICT.	5	2	3	8	12	2.33
12.	There is no proper space in classroom to demonstrate Instructional materials.	7	4	0	11	8	2.7
13.	Hardware and software problems often disturb the lesson.	13	8	1	2	5	3.63
14.	Time period of lesson is sufficient to teach the lesson.	5	4	1	8	12	3.6
15.	Passive participation of students in ICT based classroom.	11	7	2	4	6	3.43
D	Course content and Curriculum						

16.	It is easy to complete the course in time by using ICT in teaching activities.	5	6	1	8	10	3.4
17.	Inability to make a link between ICT tools and the curriculum.	10	9	0	5	6	3.4
18.	Unavailability of software relevant to mathematical content and curriculum.	8	12	2	4	4	3.53
19.	Some contents are difficult to teach by using mathematical software.	9	7	3	7	4	3.33
20.	Lack of teacher involvement in curriculum planning.	11	7	2	6	4	3.5
E	Teacher's Training						
21.	Training is not based on need and demand it is only formality and upgrading.	15	4	0	6	5	3.6
22.	There is no any training schedule to improve teaching learning activities in our school.	13	5	0	7	5	3.47
23.	The trainers are not very good at content deliver the training.	4	5	2	9	10	2.47
24.	Trainers are not well	14	5	4	5	2	3.8

	experienced and skillful in the use of ICT to deliver the training.						
25.	I deliver the knowledge and teaching strategies in ICT based classroom whatever I have learned in the training program.	12	8	0	3	7	2.5

In your view state other challenges faced by mathematics teachers in using ICT in teaching mathematics in your school.

(i)

(ii)

(iii)

In your words, what are the solutions to the challenges faced by mathematics teachers in using ICT in teaching mathematics in your schools?

.....

Appendix-III

Interview Guidelines for Principal

Schools name and Location:

Name of the responder:

Gender:

Qualification:

Teaching Subject:

Teaching Experience:

Training:

Focuses Point of Interview with principal

- Access of Technology
- Administrative Support
- Time and Classroom Management
- Course, content and curriculum
- Teacher's Training
- Challenges Related to using ICT and Possible solution etc.

Appendix-IV

Class Observation Checklist

Name of teacher:

Gender:

Grade: Period: Subject: Title:

.....

Name of school:

.....

Date:

Time:

Observation checklist for classroom interaction

1. Physical Features

- a) Computer lab
- b) Lighting in the lab
- c) Computers positioned in the lab
- d) Learners sitting arrangements
- e) Condition of the computers
- f) No. of operational computers
- g) No. of computers connected to a printer and internet
- h) Name of applicable system available in computer
- i) Name of Math's software programs available

1. Initiation of the lesson		Yes	No	Remark
	Was the lesson objective clear to student?			
	Was the lesson based on the previous one?			
	Were the students ready to learn?			
	Was the start of the lesson interesting?			

2. Appearance in the classroom		Good	Tolerable	Poor	Remark
	Clean				
	Self-Confident				
	Punctual				
	Pleasing				

3. Development of lesson		Yes	No	Remark
	I. Subject matter and sequence			
	The Relevant to curriculum			
	Relevant to text book			
	Relevant to the students level and interest			
	Teachers command over subject matter			

II. Language	Good	Tolerable	Poor	Remark
Fluency				
Voice				
Structure				
Clarity				

III. ICT as Instructional materials	Good	Tolerable	Poor	Remark
Condition of ICT's tools				
Appropriateness of ICT to the lesson				
Size and clarity				
Teacher's skills about ICT				
Time management				

IV. Student participation	Frequently	Sometime	Seldom	Remark
Listen Alternatively				
Ask question relatively				
Answer teachers question				
Participate in direction				
Follow direction				
Experiment				
Any other activity				

V. Teacher's Activities	Frequently	Sometime	Seldom	Remarks
Lecture				
Question				

Answer the students				
Encourage students				
Discourage students				
Discuss with the students				
Listen to students questions				

Mention the observed challenges faced by teacher in using ICT in teaching mathematics.

.....
.....

Suggestion for improve the teaching the lesson.

.....
.....