

**INTEGRATION OF ICT IN TEACHING MATHEMATICS: STUDENT'S
PERSPECTIVE**

**A
THESIS
BY
PRAKASH BAM**

**IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR MASTER
DEGREE OF MATHEMATICS EDUCATION**

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Letter of Certification

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This thesis entitled **Integration of ICT in Teaching Mathematics: Student's Perspective** submitted by Mr. Prakash Bam in partial fulfillment of the requirement for the Master's Degree in Education has been approved.

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Recommendation for Acceptance

This is to certify that Mr. Prakash Bam has completed his M. Ed. thesis entitled **Integration of ICT in Teaching Mathematics: Student's Perspective** under my supervision during the period prescribed the rules and regulations of Tribhuvan University, Kirtipur, Kathmandu, Nepal. I recommend and forward his thesis to the Department of Mathematics Education to organize final viva-voice.

.....

(Mr. Lok Nath Bhattarai)

Supervisor

Date:

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Dedication

Honestly dedicated

To

My Parents

Father Mohan Bahadur Bam and Mother Kokila Devi Bam

Declaration

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

Date:.....

Prakash Bam

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.....

Prakash Bam

Abstract

The integration of information and technology (ICT) has become essential in teaching learning process especially in mathematics. This research is based on mixed design entitled, "Integration of ICT in Teaching Mathematics; Student's Perspective." The main purpose of this research was to explore the perspectives of students and to compare the perspectives of students as their gender regarding integration of ICT in teaching mathematics. To achieve these purposes a set of questionnaire was prepared containing 25 statements categorizing on the basis of five dimension of Bloom's taxonomy (receiving, responding, valuing, organizing, and characterizing) for 100 samples (75 boys and 25 girls) from Tribhuvan University Kirtipur, Kathmandu. The data were collected by Likert's five point rating scale and analyzed with the help of SPSS software 21.0 to get value of statistics chi-square, percentage, mean, standard deviation and t-test for objective first and second respectively. The interview was also conducted on four student selected by random sampling to make data more valid. The findings; mean value of boys' is 3.72 with standard deviation 0.52 and that of girls is 3.24 with standard deviation 0.31. In comparison of boys and girls perspectives the calculated t-value was 5.58 which is greater than tabulated value 1.96. So, null hypothesis is rejected and alternate hypothesis is accepted which shows that there significance difference between the perspectives of boys and girls students.

By the analysis and interpretation of obtained data it is concluded that the students have positive perspective about the integration of ICT in teaching mathematics. There is significance difference between the perspectives of boys and girls students towards the integration of ICT in teaching mathematics as it increases students learning ability, willingness, participation and eases to; prepare assignment, receive feedback from teacher as well as it develops communication skill and makes classroom interactive, also it provides; independence & autonomy to the learner, knowledge about the utility of mathematics with collaborative and e-learning environment.

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Chapter-I

INTRODUCTION

This chapter entails the background of the study, statement of the problem, research question, objective of the study, significance of the study, hypothesis of the study, delimitation of the study and lastly, the operational definition of the terms.

Background of the Study

Mathematics is considered as a system formed from ideas and connection and developed by sequential process of abstraction and generalization. Students often have difficulties to concretize abstract issues especially when they need to construct mathematical relations and generalization. Technology offers important opportunity to overcome these problems by providing visualization and dynamic structure tools. There is a constantly increasing number of software packages that can be used as a powerful tools in mathematics teaching. Recent research shows that computer programs such as Maple, Mathematica, Drive, Geometer's Sketchpad, Geogebra when used in a classroom support creative discoveries and mathematical generalization.

Today's student's live in a global knowledge based age and they deserve teachers whose practice embraces the best that technology and bring to learning (Lamke, 1999). Mathematical software and social media for effective and interactive learning that must be used to self-learning, sharing based learning, collaborative learning, web based learning and virtually learning for teaching and learning.

In particular way in this regard it is essential for the students to be prepared for the future life so the future life of student depends on his /her education system. In the present days human beings are illiterate without technological knowledge. So, our education system must be technological base. The students do not understand the

mathematical concepts and are not able to link them with their real life situation without using technology. If the teacher use manipulative material, ICT, Mathematica, Geogebra, Mathlab etc. then learning will be effective that cause to increase the achievement of students.

Integration of ICT in teaching mathematics helps the student and teacher to improve engagement, improve knowledge relation, encourage individual learning, encourage collaboration, student can learn useful life skill though technology and it also helps to teacher content delivery. It can give teacher and students great resource, new opportunity for learning, way to collaborate and create and save money. It is very powerful tools for the betterment of education, meaningful contact between teachers and students working on the same activity out of school, ways for students to view and build on the work of others in their group or class, purposeful interaction between students in different schools, levels or classes across time frames and distance, a means to enhance the participation of all students. It gives facility for timely feedback from teachers and peers.

ICT stands for information and communication technology defined as diverse set of technological tools and resource used to communicate and to create ,disseminate , store and manage information (Gunton,1993; Victoria,2002) .ICT is divided into two main approaches in education such as ; ICT for education and ICT in education . ICT for education implies the development of information communication technology for learning and teaching purpose while ICT in education involves the adoption of general components of ICT in practical use in teaching and learning process.

Today the limitations have been broken by technology. A teacher can have several students all over the world through virtual classrooms. With the use of phones,

skype and other devices alike the teacher and the students can easily get connected making it possible for teaching and learning to take different innovative platforms. It is seemingly difficult, if not impossible, to address quality education without making mention of the use of ICT. ICT is considered as one of the pillars upon which quality education for all can indeed become a reality, because of its unique capacity to bring the world together.

A study (sah, Ayub and Tarmizi,2010) concluded that the use of ICT enhanced the students' performance in learning mathematical knowledge. Other studies (Shadaan and EU,2013,Zengin, Furkon andKutuluca,2012) found that there were significant difference in the mean score between experimental groups and control groups using ICT, in these settings, the experimental group outperformed the control group by a large margin. Guvin(2012) reported that the using ICT as a teaching tool, the experimental group outperformed the control group not only in academic achievement but also in levels of learning of derivative and anti derivative. Dynamic software (mathematica) has positive affects on students' learning and achievement. Teaching and learning with use of ICT has many advantages such as providing greater learning opportunity for students, enhancing students achievement and encouraging discovery learning (Bennet;1999). In the teaching and learning mathematics, especially derivative, anti-derivatives, probability etc. It is important for students to be able to imagine, construct and understand construction of shape on order to connect them with related facts. Therefore a computer will assist students in imagining and making observations (Dogan,2010).

Statement of the Problem

Due the modernization and technological advantages and time, it would also be useful for all teachers to strive for in using innovation in conveying variety of

teaching techniques or aids in class as this will somehow contribute to the lesson success. Text book cannot visualize the dynamic nature of mathematical figures on paper. As a consequence students are forced to mentally investigate the possible properties of mathematical objects without an external way to increase understanding of related concepts and therefore students often fail to develop insights into the taught concepts. Thus internalizing the mathematical representation is a psychological challenge to students on paper pencil medium, which makes mathematics difficult to many students. This problem remains persistent in learning environment which lacks dynamic features that may facilitate the justification and validation of definition, axiom and theorem in perspective manner.

So, to solve the above problem, integration of ICT would play significant role to address the problem of the students understanding the mathematical concept through visualizing the subsequent steps of construction process. Many studies about use of ICT in teaching mathematics have found that the use of ICT in learning mathematics has positive impacts on student's achievement in learning. No previous study was done to explore Integration of ICT as a tool in teaching and learning mathematics in Nepal. So I choose the topic on my thesis to partial fulfillment of master's degree course the Integration of ICT in Mathematics: Student's Perspective

Research Questions

- What are the perspectives of students regarding Integration of ICT in mathematics teaching?
- Is there significant difference between the perspectives of students as their gender towards Integration of ICT in teaching mathematics?

Objectives of the Study

The main objective of this study has the following objectives:

- To explore the perspective of students towards integration of ICT in teaching mathematics.
- To compare the gender wise perspectives of students on the Integration of ICT in teaching Mathematics.

Significance of the Study

The significance of the study is a statement of why the study is being conducted, or the goal of the study. The goal of the study might be identified, describe a concept, to explain or predict a situation or solution to a situation that indicates the type of study to be conducted (Beckingham, 1974). If we use ICT in mathematics teaching then our students not only hear and see but they play with ICT is great fun in learning. The integration of ICT in mathematics teaching definitely helps them to visualize the mathematical concepts in a better way and believe it is definitely inspiring them to learn mathematics.

Investigating the extent to perspective of students towards integration of ICT in teaching mathematics and whether they believe in its importance, are the main significance of this study. This research will be beneficial to stakeholders, teachers, students, policy makers and those who are interested in the mathematics education field.

This study has the following significance

- The study provides the perspective of students towards integration of ICT in teaching mathematics.
- This study would help to compare the gender wise perspective of students towards the integration of ICT in teaching mathematics.

- It would be significant for teacher to know the perspectives of students towards integration of ICT in teaching mathematics.
- The use of ICT can provide our student an opportunity to explore and build up new conceptual understanding in mathematics.
- The research would be helpful to empower teacher and students for teaching and learning by integrating ICT in mathematics learning.
- It is helpful for national policy makers' mathematics curriculum administrator to make appropriate decision in ICT based software in mathematics teaching.
- It is helpful for further research towards integration of ICT in mathematics teaching.

Hypothesis of the Study

The Hypothesis formulated for this study is as follows:

- There is a positive perspective of students towards the integration of ICT in teaching mathematics.
- Null Hypothesis: There is no significant difference between gender wise perspectives of students towards the integration of ICT in teaching mathematics.
- Alternate Hypothesis: There is significance difference between the gender wise perspectives of students toward the integration of ICT in teaching mathematics

Delimitation of the Study

Delimitation is the boundaries that are set by researcher in order to control the range of the study. Due to the certain time, expenses and other related factors the

researcher cannot overcome the entire field. The delimitation of the study are as follows:

- This study was conducted only on the master level students of university campus, Kirtipur.
- The study contains 100 (75 boys and 25 girl's) student of Tribhuvan University; Department of Mathematics Education.
- The study was limited to find out the students' perspective towards integration of ICT in teaching mathematics only.

Operational Definition of Related Terms

An operational definition is such types of terms which decide to measure the variables in the study. On this study the following are the operational terms of the study:

Integration: Integration is a act of combining various elements into a whole

Mathematica: Mathematica is a scientific mathematical computer program sometimes called computer algebra used in many scientific, engineering, mathematical and computing fields.

ICT: Information communication technologies (ICT) is a broader term for information technology (IT) which refers to all communication technologies including the internet, wireless networks, cell phones, computers, software, middleware, video conferencing, social networking and other media applications and services.

Computer: Computer is an electronic device that performs processes, calculation and operation based on instruction provided by a software or hardware program. It has ability to accept data (input), process it and the produce outputs.

Perspective: Perspective is an attitude towards or way of regarding something; a point of view.

Chapter-II

REVIEW OF THE RELATED LITERATURE

The literature review helps to get better understanding of the study problem in terms of trends and methods. In this regard Kumar Shah(2017) says that literature review can help in four ways; bringing clarity and focus to research problem, improve to research methodology; broaden knowledge base in research area; and contextualize findings. Therefore for selecting design, sample, tool, data collection procedure, analyzing data and making decision, it gives instructions and make reliable research.

Empirical Literature

Empirical literature review contains the methodology adopted, key finding and conclusion on previous study that have been done on the similar topic by other researcher. The major propose of present study is to find the perspectives of students and compare their perspectives. There are so many journals, reports and related research studies in order to explain the present problem of the study. These are as follow:

Alrshedi, (2012) conducted a study aimed at discovering the degree to which the faculty members at the University of Hail use social media in their teaching. The survey was used to achieve the goals of the study. The sample group was 157 faculty members, representing 10% of the faculty population. The general result in terms of degree of social media use among the sample group was moderate. The researcher arranged the survey's domains according to the degree of which the social media use from the most to the least as: research and idea change, communications with colleagues, continuous learning, and subject design and methods. No significant differences were found between the sample group responses in relation to their gender

or experience except for a significant difference related to gender in the communications with colleague's domain.

Likewise, Shrestha, (2014) Conducted a research on "Status of ICT use in teaching learning mathematics". The study followed the qualitative method to investigate the uses of ICT in mathematics teaching and learning in Heartland Children's Academy (HCA). In school where the computer lab for teaching and learning are taken as population of the study, three mathematics teachers were selected purposively and 20 students were selected. This study follows an evaluative case study and observation and interview are used as major data collection tools. Data were collected through the primary source. Interviews were conducted after the observation. Descriptive and interpretive analysis was used to analyze the data. She found from the study there were no any plan on the use of education technology tools in teaching and learning mathematics and insufficient resources for ICT tools. Inadequate training of teachers on ICT tools usage in teaching and learning and absence of guidelines or policy on use of ICT tools were reasons for not used the tools in Mathematics teaching and learning. Also she found the language problem, lack of basic knowledge, lack of supervision and guidelines on ICT are problems, but ICT helps the student to become more active in the education process

The very same one, Echenique, Molías, and Bullen (2015) conducted a study related to the social and academic use of digital technology. The main analysis tool for this study was some in-depth, face-to-face interviews with students at the Open University of Catalonia (Spain). The goal of these interviews was to show how students use social media technology in their social academic lives. The results showed that the degree to which the digital technology was used by students depended on their purpose and their level of their competence, and that using such

social media applications as WhatsApp were very important to students, because they facilitate their social and academic life when it comes to sharing ideas and interests.

Likewise, Chesitit, (2015) Conducted a research on "Impact of ICT integration on mathematics performance in Kenya" to determine the role of ICT in integration in teaching and learning on mathematics performance in public secondary school in Kenya. The research design was experimental in which students from five schools, two boys' schools, two girls schools and one mixed day school participated. To identify class streams and students to take part in the study, simple random sampling technique was applied. For validity and reliability pilot survey construct on 5 school had a computer laboratory that could be use mathematics to math through ICT. The data file was subjected to statistical procedures to generate means and standard deviations of the two groups in the various schools as well as the mean of these means. Statistical Package for Social Sciences (SPSS) was used to define the variables, categorize the data in classes, create tables and generate graphs. To test the significance of difference between means of 2 independent samples at 95% confidence limit with 2 tails was generated.

The key findings were that the experimental group performed better than the control group in all the 5 schools. These results indicated significant differences due to flexibility and focused interest in classes where ICT was integrated. It was concluded that ICT integration in mathematics teaching brings about better understanding of concepts and skill transfer from abstract to concrete. Integration of ICT in teaching and learning mathematics especially so for abstract concepts such as waves, helped to overcome such limitations, hence impacted positively on the performance in the test scores.

In this way, Acharya, (2015) conducted a study on “effectiveness of GeoGebra software on mathematics achievement”. On the purpose of compare the achievement of the topic learning circle by using GeoGebra software with the achievement of student taught without using GeoGebra software. He follows the Vygotsky’s social constructivist theory. The research design is quasi-experimental so he makes two groups one is experimental group having 28 students and another is control groups having 25 students. The data collection tools were pretest and posttest on the basis of set of questionnaire for experimental group using Likert’s scale and the data were analyzed by mean, variance, standard deviation and t-distribution at 0.05 level of significance. The researcher concluded that the GeoGebra software has effective tools in mathematics teaching and learning specially in learning circles. The GeoGebra software has a positive impact in student in the topics circle and students have positive perception on GeoGebra software.

Also, Albalawi (2017) conducted an international research on “Mathematics teacher’s perception of using social media in their teaching in Tabuk, Saudi Arabia”. The purpose of this study was to discover the status of social media use among mathematics teachers in the classroom. Based on gender, experience, and the level at which they teach. The sample for the study was 142 mathematics teachers (82 males and 60 female) teaching at different schools in Tabuk, Saudi Arabia. The findings refer to moderate use of social media among teachers who sometimes use it in their teaching with no specific target however they believe in the importance of using social media in their teaching and perceive it positively. Moreover, findings revealed that in both domains. The participants mean differ significantly, favoring female teachers over male teacher. However, there was no significant difference among participants in either domain in relation to experience or level of school taught.

These four research shows that the effectiveness of ICT in the teaching fields is positive as well as the perception of teacher, student also positive for using new dimension on teaching and learning aspect. This research also shows that the learning with ICT gives progressive results of student then the learning without ICT. It can be concluded that the use of social media and digital technologies help to student as well as teacher in the learning and teaching approach. In the context of Nepal there are much study in information communication and technology in mathematics.

Similarly, Sah, S.K. (2017) Conducted a research on "Teacher attitude towards media in teaching mathematics". This research investigate attitude of community and institutional secondary schools mathematics teachers towards media in teaching mathematics and compare the attitude of them. This research is based on constructivism theory. This research adopts mixed method research and used survey research design to attain the objective of the study. Take 30 mathematics teacher of the total 152 community school and 30 mathematics teacher of the total 781 institutional school were selected by simple random sampling and 10 mathematics teacher were selected for interview and class observation by purposive sampling as sample of study. Opinionnaire, interview and observation are taken as a data collection tools.

The opinionnaire tools are taken from the theory of previous research done by different researchers so assumed that tools are reliable and valid. The obtained data was analyzed by z- test to test the hypothesis at 0.05 significance level and mean, variance and SD calculate to show the attitude of teacher towards teacher using media for teaching mathematics at secondary level and compare community and institutional school teacher attitude. Mean and percentage of each statement was discussed to find attitude. For verification of quantitative result use qualitative approach. For this asked

open-ended question to teacher and analyzed responses thematically. She found that there is a significance difference between attitude of community school and found institutional school teachers has more positive towards using media in teaching mathematics than that of community school teacher at secondary level.

In this regards, Timilsena, (2017). Did a research on "Attitude of teachers towards ICT in teaching mathematics" to find the attitude of teacher towards ICT in teaching mathematics. This research is based on the belief that all individuals construct their own reality. Total 200 students, 100 teachers were selected for the sample from secondary school of Surkhet district. The data are collected through primary sources. The data are tabulated by Likert's five point scale. The collected data form questionnaire was categorized according to the category of the respondents. The significance of each statement was tested by computing corresponding χ^2 - value and comparing them with tabulated χ^2 -value 5.991, the value of χ^2 at 0.05 level significance. Secondary level teacher had positive opinion towards ICT in teaching Mathematics and most of school has ICT tools to teach mathematics but due of the lack of teacher training they could not use in real classroom. Students are interested when they are taught with ICT tools. He conclude that ICT helps to increase the flexibility in learning mathematics and it gives equally benefited to irregular students as regular students. Also ICT increases student's mathematics achievement and learning.

At the end Joshi, (2018) did a research on the topic "Attitude of master level students towards ICT in mathematics education" to find out the attitude of master level students towards ICT in mathematics education and compare the attitude of students with respect to gender. The research was based on constructivism theory. The research was cornered with mixed method. Used of quantitative data was obtained

through Survey design, questionnaire based five point Likert's scale was used which are developed in different domains and qualitative data was obtained by Interview. The validity of the tools were based on the conceptual framework and consulted with the supervisor. Its reliability was ensured by taking pilot test among 30 students. Master level students of Tribhuvan University are population of the study. The sample of the study were selected by using random sampling procedure. For first phase one hundred students are the sample of study. For second part, use of the purposive sampling method was used to select four students. He collects the data from respondents of individual and groups. To analyzed the collected data by the help of Statistical Program for Social Sciences (SPSS) software version 21.0. To find attitude of students towards the ICT, used Chi-Square test at 0.05 level of significance and percentage of each statements. The interview was recorded and transcribed under headings and then were organized in themes and categories that emerged. So there is significant difference between attitude of boys and girls students with ICT in mathematics education. Systematic classroom activities, well managed equipment and course, evaluation process helps to develop the positive attitude. He found that active participation of student in ICT classroom learning activities, use of ICT tools and evaluation system. Also found teacher should play role of instructor and students are actively participations in classroom.

Theoretical Literature

Research and theory are interrelated and inseparable. A theory provides a conceptual framework for research. Theory plans and directs the research studies. All aspects of the research are related to constructivism theory.

Connectivism

This research is connected with the connectivism as a Digital Age Learning Theory because the digital technology and social media generate the knowledge as Connectives' approach so that the digital technology and social media also associated with this theory. According to this theory researcher try to identify the main role of digital technology and social media for the teacher and student in teaching and learning mathematics, which has generated the main approach of digital technology and social media in the field of education and learning process (Downes, 2007).

George Siemens and Stephen Downes developed a theory for the digital age, called connectivism. Connectivism as social learning that was networked. Stephen Downes described it as "The thesis that knowledge was distributed across a network of connections, and therefore that learning consists of the ability to construct and traverse those networks" (Downes, 2007). Connectivism was characterized as a reflection of our society that was changing rapidly. Society was more complex, connected socially, global, and mediated by increasing advancements in technology. It was the balance of a complex confusion of ideas, networked to form specific information sets. Ways of knowing are derived from a diversity of opinions. The individual does not have control rather it was a collaboration of current ideas as seen from a present reality.

The core skill was the ability to see connections between information sources and to maintain that connection to facilitate continual learning. Decisions are supported by rapidly altering fundamentals as new information was quickly integrated to create a new climate of thinking. This constant update and shift of knowledge also can be contained outside the learner, such as in a database or other specialized information source. For the learner to be connected to this outside knowledge was more important

than his or her existing state of knowing. The first point of connectivism is the individual. Personal knowledge consists of a system of networks, which supplies an organization, which in turn gives back to the system. The individual continues the cycle of knowledge growth by his or her access back into the system.

The advantage was that the learner can remain current on any topic through the connections they have created. Within any defined social network, there was a focus for groups of people with a common goal. They can promote and sustain a well-organized flow of knowledge, (Downes 2007 cited in Betsy Duke, G. H. (n.d.)).

In general, Connectivism helps in learning as many learners move into a variety of different, possibly unrelated fields over the course of their lifetime, informal learning was a significant aspect of our learning experience. Formal education no longer comprises the majority of our learning. Learning now occurs in a variety of ways – through communities of practice, personal networks, and through completion of work-related tasks also learning was a continual process, lasting for a lifetime. Learning and work related activities are no longer separate. In many situations, they are the same, technology was altering (rewiring) our brains. The tools we use define and shape our thinking; the organization and the individual are both learning organisms. Increased attention to knowledge management highlights the need for a theory that attempts to explain the link between individual and organizational learning.

Principles of the Connectivism Theory

The connectivism theory focuses in learning and knowledge rests in diversity of opinions. It is a process of connecting specialized nodes or information sources, also it may reside in non-human appliances, capacity to know more was more critical than what was currently known. It emphasizes on for continual learning to facilitate

nurturing and maintaining connection is needed. Also, ability to see connections between fields, ideas, and concepts is a core skill, currency (accurate, up-to-date knowledge) was the intent of all connectivist learning activities and decision-making is itself a learning process. Choosing what to learn and the meaning of incoming information is seen through the lens of a shifting reality. While there is a right answer now, it may be wrong tomorrow due to alterations in the information climate affecting the decision. Principles of Connectivism (Siemens, 2004)

Landauer and Dumais (1997) explore the phenomenon that “people have much more knowledge than appears to be present in the information to which they have been exposed”. They provide a connectivist focus in stating “the simple notion that some domains of knowledge contain vast numbers of weak interrelations that, if properly exploited, can greatly amplify learning by a process of inference”. The value of pattern recognition and connecting our own “small worlds of knowledge” are apparent in the exponential impact provided to our personal learning.

Connectivism presents itself as a pedagogical approach that affords learners the ability to connect to each other via social networking or collaboration tools. Many theories assume that learning happens inside the head of an individual. Siemens believes that learning today was too complex to be processed in this way and that “we need to rely on a network of people (and, increasingly technology) to store, access, and retrieve knowledge and motivate its use” (Siemens, 2006). Learning was viewed as multi-faceted and particular tasks define which approach to learning was most appropriate to the learner (Siemens, 2003).

Conceptual Framework

A conceptual framework is an analytical tool with several variations and contexts. It is used to make conceptual distinctions and organize ideas. It helps to make roadmap about our research. Strong conceptual frameworks capture something real and do this in a way that is easy to remember and apply (encyclopedia). The conceptual framework of this study is given by following figure:

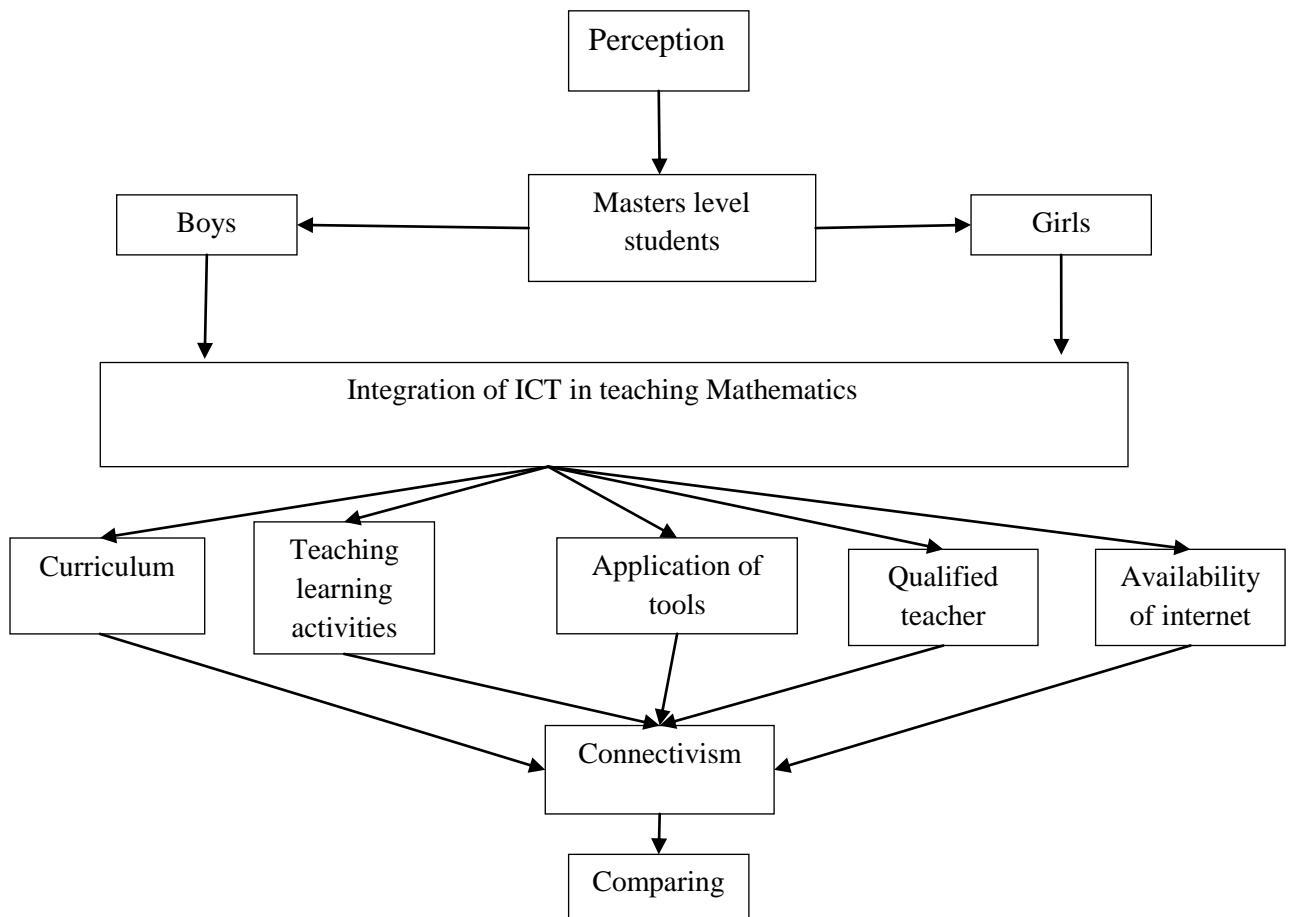


Fig: Conceptual framework; Integration of ICT in teaching mathematics.

From the above review of literature and theoretical model, researcher has come to the point that the topics of Integration of ICT in teaching mathematics: Students' perspective. The main purpose of the research is to find the perspectives of students and compare their perspective on the integration of ICT in mathematics

teaching. For that boys' and girls' perspectives are interrelated. The perspectives about curriculum, teaching learning activities, application of tools, qualified teacher, Availability of internet are main domain of the study.

For the effective use of ICT in learning mathematics there should be proper curriculum and teaching learning activities based on ICT also for effective teaching learning activities there must be use of ICT based application and tools. For proper use of ICT based tools we need qualified teacher and must be availability of internet. So they determine the perspective of integration of ICT in teaching mathematics. All these aspects creating the connectivism learning theory. So, the conceptual framework of this study is based on these aspects and connectivism theory. The researcher collected the data through questionnaire, and interview and included the positive and negative decision in final.

Chapter-III

METHODS AND PRODUCERS

This chapter describes the research methodology. The chapter includes, research design, population and sample of the study, tools of the data collection, validity and reliability of the tools, data collection procedure, with analysis and interpretation of the data

Research Design

"A research design is plan, structure and strategy of investigation so conceived as to obtain answers to research questions or problems. The plan is the complete scheme or program of the research. It includes an outline of what the investigator will do from writing the hypotheses and their operational implications to the final analysis of data" (Kerlinger, 1986). This research is concerned with mixed method which is quantitative followed by qualitative methods. The first part of the study was quantitative research. For first part, the researcher adopted the survey design in this study. Survey research is probably best adopted in obtaining personal and social facts, beliefs, concepts and opinions. So the researcher applied the survey research design to find out the perspectives of students on the integration of ICT in teaching mathematics. To ensure the perspective, in second part the researcher adopted the qualitative technique to analyze the data obtained from interview.

Population and Samples of the Study

The study was focused on the investigation of perspectives of students on integration of ICT in teaching mathematics. Until now, there are twelve universities in Nepal. Among them Triubhuvan University is one of the popular and oldest university. The university has 62 constituent campuses and 1,084 affiliated colleges

across the country and ICT is being used as a teaching tool in some programs of master level in Tribhuvan University. Therefore, M.Ed students' specializing ICT in mathematics education in Tribhuvan University are population of the study.

In first phase 75 boys students and 25 girl student were selected by using random sampling procedure as the sample. In second phase two boys and two girls students were selected randomly for depth interview. So, the researcher adopted multistage sampling procedure.

Tools of the Data Collection

Tools are important for collecting the data. There are different types of tools for collecting data which are as follows.

Questionnaire

Since the first part of research demands quantitative information so tools of research was questionnaire. A questionnaire was the major tool for data collection in the study. The questionnaire was considered on the basis of ICT in Mathematics Education curriculum, teaching learning activities of class, application of ICT tools, and evaluation system. The questionnaire was prepared in term of structured guideline of articles, published and unpublished thesis on "integration of ICT in teaching Mathematics: student's perspective". Five point Likert's Scale with the value as 5- Strongly agree, 4- Agree, 3-Neutral, 2-Disagree, 1-Strongly Disagree. For negative statements the value of 1, 2, 3, 4 and 5 was assigned for the response of strongly agreed, agreed, undecided, disagreed and strongly disagreed respectively.

Interview Guideline

The researcher prepared interview guideline (open ended interview questions) on the basis of the suggestion from supervisor and the study of research book. Interview is also kind of oral questionnaire which helped to understand participant's

perspectives, reaction, view and her / his facial expression about integration of ICT in teaching mathematics.

Validity and Reliability of Tools

"Validity is the single most important aspect of the design of any measurement instrument in educational research. However good our research design or sophisticated our statistical analyses, the results will be meaningless if we aren't actually measuring what we are purporting to measure" (Muijs, 2004). For the validation of tools researcher conducted the questionnaire form and interview guideline which was based on conceptual framework and by the help of supervisor. To ensure the validity of instruments, the researcher consulted with thesis supervisor. Its reliability was insured by taking pilot test among 8 students which is not included in the study for the reliability the obtained data were calculated by using the Statistical Package for Social Sciences (SPSS) programmer, version 21.0 setting at 0.05. The reliability coefficient was found 0.81.

Data Collection Procedure

For the data collection of this study the researcher visited the boys and girls students of the respective college and asked for permission before administering the questionnaire to the students.

The researcher personally collected the data from the respondents of individual and in groups. While collecting the data the researcher told the title, purpose of research, reason to select the topic and methods to fill up the questionnaire and distribute the questionnaire. Some respondents filled the questionnaire at the same time and rests of the questionnaire were collected after 2-3 days of the distribution. The responses of students evaluated on the basis of Likert's scale for statistical analysis follows.

Data collection procedure

The student's responses were given weight as 5, 4, 3, 2, 1 if their responses were as "strongly agree", "agree", "Neutral", "Disagree" and "Strongly disagree" respectively. For the interview four students were selected by random sampling to measure their perspective towards the integration of ICT in teaching mathematics. At the end the interview was recorded as audio and mention in paragraph.

Data Analysis and Interpretation

This is the mixed research so it is based on both quantitative and qualitative nature. When collected the data from questionnaire, the researcher analyzed the collected data by the help of Statistical Package for Social Sciences (SPSS) software version 21.0 to identify perspective of students on the integration of ICT in teaching mathematics. The researcher used Chi-Square (χ^2) test at 0.05 level of significance and percentage of each statements. For second objective, to compare gender wise perspective of student's t-test, mean and standard deviation were used at 0.05 level of significance.

More elaborately to explore the view of students on the integration of ICT in teaching mathematics the interview was conducted for this. At first researcher listened them carefully and the audio record of data on mobile phone. The researcher transcribed all the oral, verbal expression, views, and perceptions in written form that listened from audio records. After then original data were translated in English language for convenience. The information was categorized according to the category of the respondents and then different themes were given in the text of interview note. It means categories into different heading of conceptual understanding. The data were analyzed and interpreted base in developed framework of conceptual understanding,

which was previously presented. The collected data were analyzed with the help of theory and literature given in the literature section

Chapter IV

ANALYSIS AND INTERPRETATION OF DATA

This chapter consist analysis and interpretation of the data. The main purpose of this study is to explore the perspective of students towards the integration of ICT in teaching mathematics and compare gender wise perspective of students. The data were collected from 100 students of University campus, Kirtipur Kathmandu. The data was collected from the questionnaire and interview were analyzed and interpreted under five dimension of their level of perception according to cognitive domain of Bloom's Taxonomy. The questionnaire contains 25 statements to measure the perspectives of students. These statements were categorized in different domain like, receiving, responding, valuing, organizing and characterizing .Mixed method was used to measure the perspectives of students towards the integration of ICT in teaching mathematics.

The collected data were analyzed by using the Statistical Package for Social Science (SPSS) software version 21.0. This chapter presented the result of statistical analysis of collective data, which were collected master's level mathematics students of Tribhuvan University of Nepal. Total 100 students were the sample for this study. Questionnaire and interview guideline were the major tools for the collection of data in this research. The scoring each item of the questionnaire used the Likert's five point scales. This part deals with statistical analysis and interpretation of the data. For first objective Chi- square test at 0.05 level of significance and percentage were used for analyzing each statement. For second objective to compare the gender wise perspective t-test at 0.05 level of significance, mean and standard deviation were used. Thus, the obtain data were analyzed and interpreted as following heading

Student's perspectives on ICT integration

The questionnaire is given in (Appendix-A) and their responses are tabulated below and calculated by using five point Likert's scale. The obtained result was divided according as the affective domain of Bloom's Taxonomy such as: Receiving, Responding, Valuing, Organizing, and Characterization. The given table no. 1 consists statement (1-5) about the integration of ICT in teaching mathematics

Table no.1: Student's Perspectives about the reception of integration of ICT in Teaching Mathematics

S. N	Statements	SA %	A %	U %	D %	SD %	χ^2	Decisions
1	I accept all mathematical concepts while integrating ICT in mathematics	51	31	10	5	3	31.62	S
2	The Integration of ICT in teaching mathematics makes mathematics class more interesting.	48	33	10	3	6	21.17	S
3	My willingness increases while integrating ICT in teaching mathematics.	40	31	16	5	8	14.11	S
4	ICT eases to receive feedback from teacher.	37	38	13	5	7	11.86	S
5	My participation Increases while integrating ICT in teaching mathematics	37	43	14	3	3	17.95	S

Critical region: $\chi^2_{\alpha, v} = \chi^2_{0.05, 4} = 9.49 \leq$ (N.S=Non-Significant) & S= Significant

From the above table the first statement "I accept all mathematical concepts while integrating ICT in mathematics" is highly significant with the χ^2 -value 31.62 at 0.05 level of significance. A total 82% of students are agreed with this statement. So, most of students are highly positive to this statement. This shows that the use of ICT is very much fruitful for giving the concept of mathematics. Students feel easy to accept the abstract concept of mathematics while teacher use mathematical software to their classes.

On the second Statement, "The integration of ICT in teaching mathematics makes mathematics class more interesting." is also significant with the chi square value 21.17. About 81% of students are agreed, 10% are undecided and 9% are disagreeing with this statement. This shows students can use ICT as a tool to perform calculations, draw graphs which makes mathematics class more interesting while integrating ICT in teaching mathematics. So, it is concluded that most of students have positive perspectives towards this statement

The third statement, "my willingness increases while integrating ICT in teaching mathematics" is significant with the chi square value 14.11. About 71% of students are agreed, 16% are undecided and 13% are disagreeing with this statement. This shows that the most of students are positive perspective with this statement and the integrating ICT in teaching mathematics enhance the learner's willingness by facilitating the acquisition of basic skills.

The fourth statement, "ICT eases to receive feedback from teacher" is significant with the χ^2 -value 11.86 at 0.05 level of significance. A total of 75% students are agreed and 13% students are undecided and 12% students are disagreed with this statement. It shows that student's perspective on ICT eases to receive feedback from teacher is positive. This shows that Integrating ICT has the potential

to receive course feedback better more effective, more timely by teacher through variety of institution's online platform & feedback tools such as Google Classroom, digital board, Youtube, Moodle etc.

Also the statement five is significant with χ^2 -value 17.95 at 0.05 level of significance which shows that it is significant statement. It means students have positive perspective for the statement my participation increases while integrating ICT in mathematics teaching more than 80% students agreed with this statement and 14% students are undecided and 6% students are disagreed to this statement.

To make above data valid the interview was also conducted. In this regard, the students said that, *"The integration of ICT in mathematics is new concepts. For its teaching here is good management of ICT materials like computer lab, projector, smart board and other materials related to mathematic. The visualization of abstract mathematical concepts through such ICT related mathematical tools enabled us to accept mathematical concept effectively. We were used to learn mathematics with group discussing, sharing our knowledge with friends that helped to increase our willingness to learn mathematics as well as to make class interesting. Sometime we faced problem of regularity of electricity and internet and I suggest that the solar panel will be the best option for regularity of electricity and internet should be used make free access everywhere in college. Although, due to teacher's friendly behavior we feel fun and interesting while integrating ICT in teaching mathematics and I'm sure that the practical evaluation system used in ICT makes us creative and constructive."*

From the above interview, the sufficiency of curriculum and visualization of abstract mathematical knowledge through projector, smart board and other material related to ICT were helpful to receive mathematical knowledge more effectively. The

interaction among students, group discussion sharing culture and teacher's friendly behavior and role to enabling proper learning environment were helpful to make mathematics classroom more interesting and also helped to increase student's participation and willingness in learning mathematics.

One student mention that they faced problem about they had less knowledge about mathematics based software also about the regularity of internet and electricity. Besides all integrating ICT in teaching mathematics helped them to make habitual to visualize the mathematical concept and developed learning ability of students.

From the both tabulated data and interview integrating ICT in teaching mathematics demonstrates all mathematical concepts virtually and helps them to receive all mathematical concepts. Due to group discussion, sharing culture, ICT based mathematical tools and teacher's friendly behavior students learning ability, willingness and participation increased while integrating ICT in teaching mathematics. So, it is concluded that students have positive perspective towards the integration of ICT in teaching mathematics.

Students' perspectives to response

The table no.2 consists statement (5-10)and ' responses are tabulated below and calculated by using five point Likert's scale. The corresponding chi-square value related to response is given below:

Table no.2: *Student's perspective to response to the integration of ICT in teaching mathematics.*

S. N	Statements	SA %	A %	U %	D %	SD %	χ^2	Decisions
6	I feel confidence while learning mathematical concept integrating ICT in teaching mathematics	11	42	9	35	3	59.8	S
7	The use of ICT in teaching mathematics is more challenging and tedious.	8	21	10	42	19	35.2	S
8	ICT helps to prepare assignments and other project works.	4	55	5	24	12	85.3	S
9	I used to communicate with teacher while mathematics is being teaching through ICT.	70	20	7	3	0	170.3	S
10	I use ICT to find mathematical concepts in different social media.	27	53	15	4	3	88.2	S

From the above table, the statement no. six "I feel confident while learning mathematical concepts integrating ICT in teaching mathematics" is significant with the χ^2 -value 59.8 at the 0.05 level of significance. A total of 53% student are agreed with this statement and 9% students are neutral and 38% students are disagrees with this statement. So, integrating ICT in teaching mathematics promotes deep and collaborative understanding, offer easy access to information and shared resources

which makes them confident during learning mathematics. It helps to conclude that majority of students have positive perspective to this statement.

On the statement no. seven "The use of ICT in teaching mathematics is more challenging and tedious" is significant with the χ^2 -value 35.2 at 0.05 level of significance. A total of 29% students are agreed and 10% of students are neutral about this statement and 61% students are disagreeing with this statement. So, due to inadequate computer in the classroom, lack of proper training skills and expert technical staff students faced challenges while using ICT in teaching mathematics. So, No all students have not positive view with this statement.

The χ^2 -value of the statement eight "ICT helps to prepare assignment and other project work" is 85.3 which is significant at 0.05 level of significance from the total students 59% students are agreed and 5% students are neutral and 36% students are disagree with this statement. So, integrating ICT in teaching mathematics being used to assist students to learn more elaborately by providing them with access to a wide range of new pedagogy which makes them easier to prepare their assignment and other project work This concludes that majority of students have positive perspective with this statement.

On the statement nine "I used to communicate with teacher while mathematics is being teaching through ICT" is highly significant with the χ^2 -value 170.3 at 0.05 level significance. A total of 90% students are agreed and 7% students are Neutral and 3% students are disagreed with this statement. So, for e-mail, chat, programming, graphics, online search for literature student should have to communicate with teacher. It helps to researcher to conclude that the majority of the students use to communicate with teacher while mathematics is being teaching through ICT.

The χ^2 -value of statement ten "I use ICT to find mathematical concepts in different social media" is significant with chi square value 88.2 which is highly significant at 0.05 level of significance. Among all students 90% students are agreed with this statement 15% students are Neutral, 5% students are disagreed with this statement. It shows that Students use different social media as a tool to perform calculations, draw graphs, and help solve problems. It helps to conclude to the researcher that most of the students use to find mathematical concepts through social Media.

From the analysis of above table no.2 most of the statements had positive perspective of students towards integration of ICT in teaching mathematics and on the statement seven the use of ICT in teaching mathematics is more challenging and tedious is also significant with chi square value 35.2 had not positive perspective. A total of 29% students are agreed and 10% of students are neutral about this statement and 61% students are disagreeing with this statement. So, researcher concluded that students have face problems while using ICT in teaching mathematics.

To make valid the perspectives of students towards the integration of ICT in teaching mathematics the researcher conducted interview of some student which is as below:

The students said that, *"The curriculum developed for ICT is adequate. It is too much helpful to build logical reasoning, verbal ability and due to our curricular nature we got more opportunity to communicate with our teacher and friends that is helpful to develop our communication skill. The pedagogical skill and motivation given by our teacher during our class enabled us to confident in learning mathematical concepts. Actually we use to use internet platform like Google, YouTube online resources to prepare our assignment, project work also to receive*

feedback from teacher which helped us to be creative and constructive. Sometime we faced some problem and it's been challenging to operate due to we hadn't prior knowledge of about mathematical software. After its daily use in our classroom we became habitual of it. Besides of all I'm happy with I got opportunity to learn ICT course in master's level which helped me to make habitual to visualize the mathematics concepts. In aggregate integrating ICT in teaching mathematics developed our learning ability".

The students told that the curriculum of ICT in mathematics was helpful to build logical reasoning, verbal ability and they got more opportunity to communicate with teacher and friends regarding their topic of studying which help to developed their communication skills with teacher and friends. The pedagogical skill and motivation given by teacher during integration of ICT in teaching mathematics made them confident in learning mathematical concept. The internet platform Google email, YouTube were helpful to prepare assignment, project work also to receive feedback from teacher. With the help of these platforms they used to find mathematical concepts which helped them to be creative and constructive. The students also told that the use of ICT in teaching mathematics had been more challenging and difficult to operate because of they hadn't prior knowledge about ICT based software like Mathematica, Geogebra but after they become habitual to operate such type of software in their daily classes they enjoyed while integrating ICT in teaching mathematics.

Hence from tabulated data and above interview it is concluded that the integration of ICT in teaching mathematics helpful to make classroom interactive, preparing assignment, to receive feedback from teacher also to develop communication skills and to make student creative and constructive.

Valuing towards integration of ICT in teaching mathematics

Among the five dimension of cognitive domain of Bloom's taxonomy valuing is the third domain. In the given table3 statements 11-15 related on the domain valuing. This table consist the value of student's perspectives towards Integration of ICT in Teaching Mathematics.

Table no.3: *Student's Perspective to valuing the integration of ICT in teaching mathematics.*

S. N	Statements	SA %	A %	U %	D %	SD %	χ^2	Decisions
11	ICT facilitate the group activities and sharing culture	48	38	11	2	1	100.8	S
12	ICT eases to overview each lesion in short period of time.	28	53	14	5	0	93.4	S
13	ICT in mathematics is easy to learn making group of students.	37	36	19	6	2	56.7	S
14	The interruption in ICT based software sometime prevents my mathematics learning.	35	45	15	5	0	82.6	S
15	Integrating of ICT in mathematics improved my problem solving skill and logical reasoning.	33	47	16	2	0	81.3	S

Analysis of the table 3 the χ^2 – value of statement eleven is 100.8 which is significant at 0.05 level of significance. From the total sample students, more than88% students were agreed with this statement. Now from the χ^2 – value and percent of statements most of the student are agreed to ICT facilitate the group activities and sharing culture. The statements twelve and thirteen have χ^2 – value 93.4 and 56.7 respectively

at 0.05 level of significance. More than 70% students were agreed on these statements which show that ICT eases to overview each lesson short period of time and makes easy to learn mathematical concept making group of students. This means integrating ICT in teaching mathematics helpful for peer learning

Similarly, in statement fourteen "The interruption in ICT based software sometime prevents my mathematics learning." is significant with chi square value 82.6 at 0.05 level of significance. In a total exactly 80% students are agreed on this statement. This shows that the interruption in ICT based software sometime prevented the students' mathematics learning. This shows that most of the students have positive perspective to this statement.

In statement fifteen, "Integrating of ICT in mathematics improved my problem solving skill and logical reasoning." is significant with χ^2 – value 81 at 0.05 level of significance 80% are agreed with this statement. This shows that the integration of mathematics in teaching mathematics helps to increase student's problem solving skill and logical reasoning which concluded that most of students have positive perspective to this statement.

Similarly, in this regard the interviewee replied that, "*Our ICT's course is so effective because mathematical software that displays our subject matter virtually and filters information. Also it encourages us for peer learning. During our ICT's class we use to learn in pairs and discuss challenging mathematical problem in our group which was helpful to facilitate group activities and sharing culture. Social media is too much helpful for our learning process that eases overview our lesson in short period of time. Due to our teacher's skill to allow us to monitor and manage our own learning, think critically and creatively also to work collaboratively solving mathematical problem through ICT helped us to improve our problem solving skill. Sometime due to low connectivity of internet, power connectivity and lack of own our*

personal skill regarding ICT based mathematical software interrupted our learning activities but we are happy to got opportunity to learn mathematics integrating ICT in our curriculum."

The students shared their feelings as the ICT gives typical visual display of mathematical concepts, filters information and encourage peer learning among students also it involves putting students into pairs and asking them to discuss a challenging mathematical problem was helpful to facilitate group activities and sharing culture. Also by the help of online platforms Google, YouTube videos made by teacher and students regarding mathematical problem eases to overview their lesson in short period of time. Students also said that the teacher's skill to allow student to monitor and manage their own learning, think critically and creatively, work collaboratively to solve mathematical problem through ICT was helpful to improve students' problem solving skill.

Students also mention that due to the lack of low connectivity of internet, power connectivity and lack of their own personal skill regarding ICT based mathematical software sometime interrupted their learning activities although they were happy as they got opportunity to learn mathematics integrating ICT in their curriculum.

Hence, from the above information it is concluded that students have positive perspective in integration of ICT as it facilitate group activities and sharing culture, encourages peer learning, also to think critically and creatively, work collaboratively, eases to overview students' lesson to revise in short period of time and improving students problem solving skill.

Student's perspectives to organizing

Organizing is a fourth dimension among the five dimensions Bloom's Taxonomy to measuring the perspectives of students towards integrating ICT in teaching

mathematics. In below mention table no. 4. statements 16-21 are related to their Perspectives. The result under this category is presented in table four.

Table No 4: Student's perspectives to organize the Integration of mathematics in teaching mathematics.

S. N	Statements	SA %	A %	U %	D %	SD %	χ^2	Decisions
16	Integration of ICT in teaching mathematics increases the motivation of students in learning process.	38	49	8	4	1	96.1	S
17	The integration of ICT in mathematics is necessary to increase students interest in mathematics	39	36	18	5	0	61.2	S
18	The availability of ICT based software is not sufficient.	32	44	12	6	5	61	S
19	I feel mathematics teaching through ICT more expensive and difficult to operate.	33	52	12	2	1	96.7	S
20	I learnt a lot about utility of mathematics integrating ICT in teaching mathematics.	40	47	8	4	1	94.5	S
21	I would like to integrate ICT in my future's teaching learning activities.	45	40	8	5	1	87.4	S

In the statement 16, "Integration of ICT in teaching mathematics increases the motivation of students in learning process" is significant with the chi square value 96.1. The result shows that more than 80% student are agreed in this statement. It

means that the students had high motivation while integrating ICT in teaching mathematics. This concludes that students had positive perspective to this statement.

Statement 17, "the integration of ICT in mathematics is necessary to increase students interest in mathematics" is significant with χ^2 -value 61.2 about 75% students were agreed to this statements. From the perspective of students, it is concluded that the integration of ICT is necessary to increase students' interest in mathematics.

Also, the statement 18, "the availability of ICT based software is not sufficient" is significant with χ^2 – value 61 about 75% students agreed to this statement. This shows that the availability of ICT based software is not sufficient in teaching mathematics which concludes that most of students have positive perspective to this statement.

Similarly statement nineteen "I feel mathematics teaching through ICT more expensive and difficult to operate" is significant with χ^2 – value 96.7. This shows that more than 80% students agreed on this statement, 12% student responded Neutral and 3% students disagreed to this statement Therefore, the result shows that the mathematics teaching through ICT more expensive and difficult to operate and its concludes that students have positive perspective to this statement.

In the statement 20, "I learnt a lot about utility of mathematics integrating ICT in teaching mathematics" is also significant with chi square value 94.5 more than 80% students were agreed to this statement. There were 8% students responded undecided and 5% students disagreed to this statement it means most of the students learnt a lot about utility of mathematics while integrating ICT in teaching mathematics. So, its concluded that students were positive about they learnt a lot about utility of mathematics while integrating ICT in teaching mathematics.

Similarly, statement 21 "I would like to integrate ICT in my future teaching learning activities" is significant with chi square value 87.4 at 0.05 level of significance. From the total samples student's more than 80% Student agreed with this statement as they would like to integrate ICT in their future's teaching learning activities. This shows that students have positive perspectives towards this statement.

To make valid above data interview was also conducted for which students said that, *"I think the Integration of ICT in teaching mathematics is necessary because when our teacher uses to teach mathematics through ICT we take more interest thus our commitment to learn mathematics also increases. Also when we have given task to do relating computer we become busier and express more positive feelings using computer. In initial period of taking ICT's course in teaching mathematics I feel difficulty to solve problems related to probability, Derivative and Anti- derivative because of its various of types of command but later I felt easy due to my regular practice on ICT related software like mathematica and Geogebra that enabled us to implementation and usefulness of such mathematical knowledge. Learning mathematics through integrating ICT is quite expensive than learning integrating ICT because we have to equal access of computer, internet and mathematical software."*

The interviewee told that when their teacher integrates ICT in teaching mathematics then students take more interest in learning thus their commitment to learning mathematics also increases. Students were busier on task and express more positive feelings when they use computers than when they were given other task to do. That's why the integration of ICT in teaching mathematics is necessary to increase students' motivation and interest in learning mathematics. Also, they said that the demonstration of mathematical problem in concrete form through mathematical software, projector, and smart board was helpful to make more aware to understand

about implementation and usefulness of their mathematical knowledge in their daily life and real world which was helpful to learn about the utility of mathematics.

The interviewee also mention that learn mathematics integrating ICT they should have access of computer, internet, mathematical software which is some expensive than learning mathematics without integrating ICT. Besides that the students were positive to integrate ICT in mathematics because of its benefits in teaching learning activities.

From the above interview and tabulated data it is concluded that students have positive perspective to the integration of ICT in teaching mathematics as it increases motivation and interest of students, makes students aware about the implementation as well as usefulness of their mathematical knowledge in real world, provides knowledge about the utility of mathematics and motivates them to integrate ICT based mathematical tools in their future's teaching learning activities.

Student's perspective to characterizing

Characterizing is a last dimension among the five dimensions to measuring the perspectives of students towards the integration of ICT in teaching mathematics. The table no.5 given below contains statements 21-25 are related to Perspective of students towards Integration of ICT in teaching mathematics under the Bloom's taxonomy characterizing. The result under this category is presented below:

Table No. 5: Student perspectives to characterizing ICT integration in teaching mathematics

S.N	STATEMENTS	SA %	A %	U %	D %	SD %	χ^2	Decisions
22	Integrating ICT in teaching mathematics makes easier to find information about the topic.	17	55	20	6	1	94.8	S
23	Course content of ICT in teaching mathematics are not sufficient.	35	45	16	3	1	80.4	S
24	Integration of ICT in teaching mathematics is flexible and provides comfortable learning.	40	47	9	4	0	97.6	S
25	I am happy with the software equipment in my curriculum	30	52	15	3	0	94.3	S

From the above table statement 22 "Integrating ICT in teaching mathematics makes easier to find information about the topic" is significant with χ^2 – value 94.8 which is more than 9.49. More than 70% students are agreed to this statement. Hence, from the χ^2 value and percentage of statements integrating ICT in teaching mathematics makes easier to find information about the topic.

Similarly, the statement 23 "Course content of ICT in teaching mathematics are not sufficient" is significant with chi square value 80.4 exactly 80% students agreed to this statement. Hence from above χ^2 - value and percentage students agreed with course content of ICT in teaching mathematics is not sufficient and concluded

that students have positive perspective to this statement.

Also the statement 24 "Integrating ICT in teaching mathematics is flexible and provides comfortable learning" is significant with chi square value 97.6. More than 80% student's response agreed to this statement this shows that integration of ICT in teaching mathematics is flexible and provides comfortable learning.

Likewise statement 25 "I am happy with the software equipment in my curriculum" is significant with χ^2 value 94.3 which is more than 9.49 so the statement is positive. From the percentage value more than 80% student responses agree to this statement which shows that most students were happy with the software equipment in their ICT curriculum.

From the above student's responses on questionnaire students gave positive perspective about the integration of ICT in teaching mathematics. This shows that most of the students were happy with their mathematics' curriculum while integrating ICT in teaching mathematics.

The interview was also conducted to make valid above tabulated data. In this regards the interviewee said, *"The integration of ICT in teaching mathematics is essential because it provides us immediate access to various sources in online platform which is help us to find new environment about mathematical concept and creates e- learning environment. If we download online resources of our content we can learn it everywhere as we want that's why ICT provides us independence and autonomy to our learning that is helpful for flexible and comfortable learning. So, all friends are happy with our course of ICT in mathematics. "*

The students mention that integrating ICT in teaching mathematics provides immediate access to the various sources in Google; you tube videos and creates e-learning environment which was helpful to find new information about mathematical

concepts. Student also told that integration of ICT in teaching mathematics is also helpful in flexible and comfortable learning as it provides greater independence and autonomy to students if they download online content and videos regarding their mathematical problem so that they could learn such type of content in variety of places including classroom, at home or as part of work also mention that they were happy with the course content of ICT in mathematics.

From the above information and tabulated data, it is concluded that integrating ICT in teaching mathematics creates e-learning environment, provides immediate access to the various online sources, which is helpful to find new information about mathematical concepts also it provides independence and autonomy to the learner which is helpful in flexible and comfortable learning. Hence it is concluded that students have positive perspective towards the integration of mathematics in teaching mathematics.

Comparison of gender wise perspectives

The second objective of this study was to compare the gender wise perspectives of students. To fulfill the this objective the mean perspectives score of boys and girls students towards the integration of ICT in teaching mathematics were compared with help of t-test at 0.05 level of significance, total mean score and standard deviation which are calculated as below:

Table no.6: Comparison of students' perspective about integrating ICT in teaching mathematics

Gender wise comparison	N	Mean	SD	Calculated value	t-value
Boys' students	75	3.72	0.52	5.58	±1.96
girl's students	25	3.24	0.31		

The analysis of the information mentioned in table no.6 represents there were 75 boys' students and 25 girls' students as sample with mean, standard deviation and t-value of boy's students' perspectives towards the integration of ICT in teaching mathematics. The grand mean score of boy's students and girl's students were 3.72 and 3.24 respectively. The mean difference of two groups is 0.48 it shows that the mean of boy's students is greater than that of girl's students which indicates that perspective of boys student found to be more than the girls student. Similarly, the standard deviation of boys and girls were 0.52 and 0.31 respectively which indicate that the SD of boy's perspectives is greater than that of girls' perspectives. The standard deviation of girl's perspective is calculated to be less than boys' perspective.

This figure shows that boys' students had more positive perspective than girls' students. The calculated t- value with respective to the difference of mean views score is $|t| = 5.58$ which does not lies between the interval $-1.96 \leq t \leq 1.96$ which shows that calculated value is found to be greater than tabulated value. Therefore, the null hypothesis is rejected and concluded that there is significance difference between the gender wise perspectives of boys and girls students towards the integration of ICT in

teaching mathematics and concluded that perspective of boy's students and girl's students towards the integration of ICT in teaching mathematics is not same.

Therefore, boys students have more positive perspective than that of girls students towards the integration of ICT in teaching mathematics.

Chapter V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

This chapter presents a summary of the research findings, conclusion, recommendations of the study and suggestions for further research. The first, second and third section of this chapter presents summary, major findings of the study and conclusion based on findings of the study.

Finally the last section presents recommendation for the further research.

Summary of the Study

This is mixed research design method related to Integration of ICT in teaching mathematics: Student's perspective. The objectives of this research were to explore the perspective of students towards the integration of ICT in teaching mathematics and compare student's perspective gender wise. To achieve these objectives of the study, the researcher develops one set questionnaire containing 25 statements among them statements 6,7,8,17,and 22 are negative and other are positive on the domains (curriculum, teaching learning activities, application of tools, qualified teacher, availability of internet) were developed as the tool for data collection. On the base of Likert's attitude scale (Strongly agree, agree, neutral, disagree and strongly disagree) and interview guideline. The population of the study was considered as all the students of Tribhuvan University Kirtipur, Kathmandu. The samples were selected as random sampling from 100 students (75 boys and 25 girls) of ICT in Mathematics education and four students (2 boys and 2 girls) were selected for interview by purposive sampling. To analyze the data researcher, use statistical package for social science (SPSS) software version 21.0. For first objective researcher was used chi-square test at 0.05 level of significance and percentage of each statement t-test mean and standard deviation was used to compare the perspective of students as their

gender towards the integration of ICT in teaching mathematics.

Findings of the Study

After the statistical analysis of the collected data using SPSS software the researcher yielded the following results as finding of the study:

- The calculated t-value of boys and girls students is $|t|= 5.58$. The mean value of boys' perspectives about ICT integration is 3.72 with a standard deviation of 0.52 and the mean value of girls' perspectives is 3.24 with standard deviation of 0.31 respectively.
- The mean score of boy's students (3.72) was found higher than mean score of girl's student (3.24).
- The boys' student had positive perspective than that of girls' students towards integration of ICT in teaching mathematics.
- Since calculated value of t-test $|t|= 5.58$ does not lies between the tabulated value ± 1.96 . Therefore, there is significance difference between perspectives of boys and girls students with integrating ICT in teaching mathematics.
- The integrating ICT in teaching mathematics demonstrates all mathematical concepts virtually and helps them to receive all mathematical concepts.
- Due to group discussion, sharing culture, ICT based mathematical tools and teacher's friendly behavior; students learning ability, willingness and participation increases while integrating ICT in teaching mathematics.
- The integration of ICT in teaching mathematics helpful to make classroom interactive, preparing assignment, to receive feedback from teacher also to develop communication skills and to make student creative and constructive.
- The integration of ICT in teaching mathematics facilitate group activities and sharing culture, encourages peer learning, also to think critically and

creatively, work collaboratively.

- Integration of ICT in teaching mathematics eases to overview students' lesson to revise in short period of time and improving students' problem solving skill.
- The integration of ICT in teaching mathematics provides independence and autonomy to the learner which is helpful in flexible and comfortable learning.
- The integration of ICT in teaching mathematics increases motivation and interest of students that makes students aware about the implementation as well as usefulness of their mathematical knowledge in real world.
- The integration of ICT in teaching mathematics provides knowledge about the utility of mathematics and motivates them to integrate ICT based mathematical tools in their future's teaching learning activities.
- The integration of ICT in teaching mathematics creates e-learning environment, provides immediate access to the various online sources, which is helpful to find new information about mathematical concepts.
- The students had positive perspective towards the integration of ICT in teaching mathematics.

Conclusion

This study has resulted main conclusions based on the findings that the boys and girls students have significance difference in their perspectives towards the integration of ICT in teaching mathematics. The integration of ICT in teaching mathematics has great impact on the understanding of ideas and concepts during mathematics lessons, it is logical to conclude that the students have positive perspectives towards the integration of ICT in teaching mathematics as it increases students learning ability, willingness, participation and eases; to prepare assignment, receive feedback from teacher as well as it develops communication skill. It makes

classroom interactive, provides independence & autonomy also makes aware about the utility of mathematics with collaborative and e-learning environment.

Recommendations

This study was limited in master's level student of Tribhuvan University, Kirtipur, Kathmandu. So, findings of the study can be generalized for same University. But, it can't be generalized to all affiliated colleges of Tribhuvan University of provinces, local levels and other universities. So, considering these limitations the following recommendations had been made:

- Integration of ICT should be given priority in teaching learning mathematics.
- Trained teachers to integrate ICT in teaching and learning Mathematics can't act as technicians (repair computer hardware and software) and teachers at the same time. Computer technicians should appointed by government in every computer lab of colleges.
- Internet facility is necessary and should be improve to integrate ICT in teaching mathematics.
- The government should establish ICT training centers and resource centers in each district. This will enable all Mathematics teachers to receive training on new ICT infrastructure and also it will enable them to improve their technological and pedagogical knowledge in teaching Mathematics.
- To be positive perspective of students there must be well designed course content, sufficient materials and equipment's in ICT lab, internet access, and trained teacher and evaluation system.

Recommendation for further research

On the basis of findings the following recommendations are made for further study:

- To establish the findings, similar study should be carried out to other affiliated colleges of Tribhuvan University in provinces and local level wise also in other universities.
- The similar study could be carried out to find the perspectives of students in bachelor and higher secondary level.
- It is recommended that the further study may be conducted to find the perspective of students from public and private colleges and compare their perspective on the integration of ICT in teaching mathematics.
- The similar study could be carried out to find the perspectives of the students of urban and rural area towards the integration of ICT in teaching mathematics.
- The similar study could be carried out to find the perspective of students who have learned mathematics through and without integrating ICT.

Implications

The implications of this study are as follows:

- This research will encourage teacher to integrate ICT in teaching mathematics.
- The research will suggests to the educators policy makers to draw essential policy to integrate ICT in teaching mathematics.
- Integrating ICT in teaching mathematics has positive that's why government should provide training for teacher to operate ICT based mathematical software.
- This research will encourage teachers to participate in such type of training provide by government.

REFERENCES

- Acharya, T. R. (2015). *Effectiveness of GeoGebra software on mathematics teaching*. Kathmandu, Kirtipur: Department of mathematics education.
- Albalawi, A. S. (2017). *Mathematics teachers' perception of using social media in their teaching*. Tabuk, Saudi Arabia.
- Alrshedi, S. (2012). *The degree of use of the members of faculty at the university of Hail to the social networking sites in the educational process*. Jordan: Yarmouk university.
- Binnet, D. (1999). *Exploring geometry with geometer's Sketchpad*. Emeryville, CA: Key Curriculum press
- Betsy Duke, G. H. (n.d.). *Connectivism as a digital age learning theory*, Kaplan University, USA .
- C.M, G. P. (1997). *variation in concerns and attitude of science teacher in an educational technology development programme* . Journal of Computer in Mathematics and Science Teachinga .
- Chesitit, P. C. (2015). *Impact of ICT integration on mathematics performance in Kenya*. University of Bairobi, Department of Geography and Environment Studies.
- Dahal, P. (2017). *Attitude of teacher and students towards the use of social media in teaching learning*. Kathmandu Kirtipur: Department of mathematics education T.U.

- Danai, Y. (2017). *Effectiveness of information communication and technology (ICT) in teaching Geometry*. Kathmandu kirtipur: Department of mathematics education T.U.
- Echenique, Molias and Bullen (2015) *Social and academic use of digital technology*
Open University of Catalonia Barcelona, Spain
- Jing, A. (2015). *Attitude of social network site among the student and teachers*.
Contemporary research in india: vol.5: issue: 3, ISBN 2231-2137.
- Joshi, A. D. (2018). *Attitude of master level students towards ICT in mathematics education*. An Unpublished Thesis Submitted to the Central Department of Mathematics Education, T.U., Kirtipur.
- Kerlinger, F. N. (1986). *Foundations of behavioral research*. New Work: Rinehart and Winston.
- Khanal, P. (2074). *Research methodology in education*. Kirtipur, Kathmandu: Sunlight publicattion.
- Landauer, T. K., Dumais, (1997). *A solution to Plato's problem: The latent semantic analysis theory of acquisition, induction and representation of knowledge*.
- Mahata, M. S. (2017). *Using ICT tools in teaching: perception and practice at secondary teacher*. Department of Mathematics Education T.U. Kirtipur, Kathmandu.
- Mualy, S. D., Tawade, S., & Uplane, M. (2015). *Student teacher attitude towards using ICT in teaching*. *Scholarly Research Journal for Interdisciplinary Studies*, 5(403).

- Muijs, D. (2004). *Doing quantitative research in education with SPSS*. London, Thousand Oaks, New Delhi: Sage Publications.
- Roblyer, M. D., & Hughes, J. E. (2009). *Integrating educational technology into teaching*. US: Pearson Education.
- Semerci, A., & Aydm, M. (2018). *Examining high school teacher's attitudes towards ICT used in education. International Journal of Progressive Education , 14(2)*.
- Sah, S. K. (2017). *Teacher attitude towards media in teaching mathematics*. An Unpublished Thesis Submitted to the Central Department of Mathematics Education, T.U., Kirtipur.
- Shrestha, R. (2014). *Status of ICT use in teaching learning mathematics*. An Unpublished Thesis Submitted to the Central Department of Mathematics Education, T.U., Kirtipur.
- Timilsena, T. R. (2017). *Attitude of teacher towards ICT in teaching mathematics*. An Unpublished Thesis Submitted to the Central Department of Mathematics Education, T.U., Kirtipur.
- Yekini, A. N., & Lawal, O. (2012). *Information and Communication Technologies, "Modern Perspective"*. Shomolu, Lagos: Hasfem Publication Center.
- Zovko, K. T. (2016, July 1st). *The use of ICT in teaching mathematics - A Comparative Analysis of the Success of 7th Grade Primary School Students. Croatian Journal of Education, 18, 215-221.*

Appendix- A

Integration of ICT in Teaching Mathematics: Student's Perspective

Date: 2077/.... /....

Dear students,

I am from the Central Department of Mathematics Education, TU, Kirtipur to conduct a research on "Perception of Students Towards the integration of ICT in teaching mathematics. This is for the partial fulfillment of the requirements for the degree of Master in Mathematics Education? To complete this research, I have prepared some questionnaire which is present to you. There is no right and wrong answer regarding each statement and the decision will be based on your own opinion. Researcher is very thankful for your valuable help and would like to express gratitude to you and your institution. Your opinion will be kept confidential and only used for the research purpose.

I request to fill the questionnaire as follows:

Please read carefully and respond as you feel.

You have requested not to leave blank for any statements.

Researcher

Prakash Bam

Prakash61564@gmail.com

Personal Details

Students Name:..... Age:.....

Name of Institution:.....

MobileNumber:..... Sex:..... Male Female

Please give tick mark (√) which you feel the best option where, SA= Strongly Agree, A= Agree, U= Undecided, D= Disagree and SD= Strongly Disagree

Item	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I accept all mathematical concepts while integrating ICT in mathematics.					
The Integration of ICT in teaching makes mathematics class more interesting.					
My willingness increases while integrating ICT in teaching mathematics.					
MY participation increases while Integrating ICT in teaching mathematics.					
I feel confident while learning mathematical concepts integrating ICT in teaching mathematics.					
The use of ICT in teaching mathematics is more					

challenging and tedious.					
ICT helps to prepare assignment and other project work.					
I used to communicate with teacher while mathematics is being teaching through ICT.					
I use ICT to find mathematical concepts in different social media.					
ICT facilitate group activities and sharing culture					
ICT eases to overview each lesson in short period of time.					
It is easy to learn mathematical concepts making group of students.					
The interruption in ICT based software often prevents my mathematics learning.					
Integrating ICT in mathematics improved my problem solving skill and logical reasoning.					
Integration of ICT in teaching mathematics increases the motivation of students in learning process.					
The integration of ICT in					

mathematics is necessary to increase students' interest in mathematics.					
The availability of ICT based software is not sufficient.					
I feel mathematics teaching through ICT more expensive and difficult to operate.					
I learnt a lot about utility of mathematics integrating ICT in teaching mathematics					
I would like to integrate ICT in my future's teaching learning activities					
Integrating ICT in teaching mathematics eases to find information about the topic.					
Course content of ICT based software is not sufficient.					
Integration of ICT in teaching mathematics is flexible and provides comfortable learning.					
I'm happy with the software equipment of my curriculum.					

Appendix- B

Integration of ICT in Mathematics Teaching: Student's Perspective

Interview Guideline

Curriculum

- Curricular sufficiency
- Improves students performance and achievements
- Generation of higher level thinking
- Motivation

Teaching learning activities

- Interaction and collaboration
- Sharing culture
- Group learning
- Effectiveness

Applications of tools

- ICT lab and materials
- Software
- Use of social media; Google, YouTube etc.
- visualization

Qualified teacher

- Pedagogical knowledge
- Adroitness
- Friendly behavior
- Knowledge sharing
- capacity to create learning environment

Availability of internet

- Equality
- Equitable
- Free access
- regularity