

PROFICIENCIES OF MATHEMATICS TEACHERS ON ICT

A

THESIS

BY

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Letter of Certificate

This is to certify that **Mr. Hemant Bahadur Basnet**, a student of academic year 2071/ 072 with Campus Roll No.106 /071, Thesis No. 1496, Exam Roll No. 28710283 and T.U., Registration No 9 - 2 - 677 - 102 - 2010 has completed his thesis under my supervision for the period prescribed by the rules and regulation of T.U., Nepal. The thesis entitled "**Proficiencies of Mathematics Teachers on ICT**" embodies the result of his investigation conducted during the period of 2071/074 under the Department of Mathematics Education, Central Department of Education, University Campus, Tribhuvan University, Kirtipur, Kathmandu. I hereby, recommend and forward that his thesis submitted for the evaluation for awarding the Degree of Master of Education.

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Mr. Krishna Prasad Adhikari

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Letter of Approval

A

Thesis

By

Hemant Bahadur Basnet

Entitled

"**Proficiencies of Mathematics Teachers on ICT**" has been approving in fulfillment for the requirements of the Degree of Master of Education.

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Recommendation for Acceptance

This is to certify that Mr. Hemant Bahadur Basnet has completed his M. Ed. Thesis entitled “**Proficiencies of Mathematics Teachers on ICT**” under my supervision during the period prescribed by the rules and regulations of Tribhuvan University, Kirtipur, Kathmadu, Nepal. I recommended and forward his thesis to the Department of Mathematics Education to organize final viva - voice.

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Mr. Krishna Prasad Adhikari

(Supervisor)

Date.....

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Dedication

This is dedicated to my respected mother Nim Kumari Basnet, wife Bhuma K.C Basnet and son Hebhab Basnet, all my family members and friends who supported me in every step of my life.

Declaration

I declare that this thesis is my own work which contains no materials on other accepted dissertation of degree award which has been already done in any institutions also I did declare that this thesis has not been submitted for any other degree.

.....

Hemant Bahadur Basnet

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.....

Hemant Bahadur Basnet

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Abstract

This is a study on “Proficiencies of Mathematics teachers on ICT”. The purpose of this study is to analyze the competency level of teachers on ICT and to compare the confidence level of teachers on ICT in terms of gender (male/female), types of schools (private/public) and level of teachers (basic/secondary). To achieve these goals, researcher had used survey design using questionnaire. Forty - five teachers were included in the survey from fourteen sampled schools of Ghorahi sub - metropolitan city. To analyze competency level of teachers on ICT, confidence interval was found and interpreted using arbitrary levels (0-32.33), (32.34-64.67) and (64.68-97) as low, medium and high respectively. Similarly, to compare confidence level of teachers on ICT, t-test at 0.05 level of significance was used.

The results indicated that there was medium level of competency level of teachers on ICT and there was significance difference between the confidence level of mathematics teachers on ICT in terms of gender and types of schools but not in level of teachers. This finding illustrated that confidence level of male teachers and private school’s teachers was higher than that of female and public school’s teachers respectively but confidence level of teachers was same in terms of level of teachers.

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Abbreviations

ICT: Information and Communication Technology

SSRP: School Sector Reform Plan

SSDP: School Sector Development Plan

ZPD: Zone of Proximal Development

MKO: More Knowledge Other

Chapter I

Introduction

Background of the Study

The activities of human are depending on technology in the 21st century which is also known as the age of science and technology. In each and every field, information and communication technology (ICT) is being broadly used. Cellular phones, text messaging, email and media are primary tools of communication for human. By such scenarios teaching and learning process cannot be separated from advancement of technology. Computers, voice recording, video recording devices and projectors represent a couple of the technological devices which have resulted from technology and have been integrated into schools as media for delivery information, which makes the delivery of information possible in ways other than traditional lectures and paper based formats.

ICT is being used broadly in each and every field of the world like business, engineering, astronomy and science etc. Among such fields, education is one important field in which ICT is in practice, is being used worldwide context. ICT is also being used in Teaching Mathematics. Instructional technology is the branch of education concerned with the scientific of instructional designed and development. The main purpose of instructional designed is to create engaging effective learning experiences.

Technology is essential in teaching and learning mathematics. ICT improves the way mathematics should be taught and enhances student understanding of basic concepts. Many researchers have carried out studies to evaluate the benefits of using ICT in mathematics. ICT promotes greater collaboration among students and encourages communication and the sharing of knowledge. ICT gives rapid and accurate feedbacks to

students and this contributes towards positive motivation. It also allows them to focus on strategies and interpretations of answers rather than spend time on tedious computational calculations. ICT also supports constructivist pedagogy, wherein students use technology to explore and reach an understanding of mathematical concepts. This approach promotes higher order thinking and better problem solving strategies which are in line with the recommendations forwarded by the National Council of Teachers of Mathematics (NCTM); students would then use technology to concentrate on problem-solving processes rather than on calculations related to the problems (Ittigson & Zewe, 2003, as cited in Keong, 2006).

In worldwide context, without ICT it has been impossible to do any kind of work. Similarly teachers are using ICT as subject and tools in education sector. ICT is being used in teaching learning activities, testing, planning, Evaluation, training etc. ICT is being broad and extent in the world. But our country is not seen like so. People are using computer, mobiles, laptop etc. in our country but only using for entertainment. Our country has also effort on ICT for not to deprive the adults from the present knowledge, skills and use of ICT. Formally, ICT was introduced to school level through ninth 5 years plan (2054 - 2059) in Nepal. Tenth 5 - year plan (2059 - 2064) had aimed to deliver the use of ICT towards the citizen. Different policies and plan on ICT are made in Nepal. Among them ICT policy 2067, ICT policy 2072 has been tried to implement for development and extension of ICT. ICT policy 2067 has mentioned the provisions as expansion of access of the internet to all schools, development of human resources. SSRP (2009) focused on development of ICT infrastructure in education, alternative modes of schooling through ICT. ICT master plan (2011 - 2017) aims to expand equitable access to

education, to enhance the quality of education, to reduce the digital divide to improve the service delivery system in education. In this way, many plans, act has focused on ICT and prepared policies. The main person to implement the policies is teacher. Teacher's quality is the single most important determinant of student performance. This is even more significant when using ICT. The teacher's knowledge, beliefs, and actions all affect the success of the learner. Teachers should correct or warrant the knowledge a learner constructs, therefore promoting the development of powerful and effective constructions. They must direct the student to provide experiences that can question or expand upon their previous learning. Teachers must continuously reassure students that they are doing things right, that their thinking has power and their errors are correctable. Teachers should allow students to choose activities, ask students to explain answers, and prompt all students to be involved. Implementation of policy depends upon the knowledge, skills, and understanding of teachers. So, this research was done for finding whether teachers were able to use ICT or not? Whether they had knowledge on ICT or not?

Statement of the Problem

Many researchers have shown that using ICT in teaching is better than traditional method. It gives effective result. Many countries have been trying to integrate ICT in teaching field. Our country, Nepal is also trying to integrate ICT in teaching field. SSDP (2016 - 2023) has focused on providing students with ICT skills and use of ICT as an important tool to improve class room delivery. To use ICT in mathematics teaching and to make students able to use ICT, teachers themselves must be able to use ICT skills properly because teacher is the ideal person for students. To integrate ICT in teaching

mathematics, teacher should be ready, should be prepared for using ICT. But no one has done study on the matter of teachers' skills on ICT. So this study has own significance.

Whatever the policies are made, the main person to implement the policies is teacher who must be able to use ICT in teaching but it is unknown about the teacher's capability to use ICT. The things which are unknown or which are remaining to be studied are called issues. Here, one issue had been raised that is the teacher's capability to use ICT in teaching mathematics. The main problem of this study was to find whether teachers were able to use ICT in teaching mathematics or not. Therefore, the research question for the study was given as;

- Are the mathematics teachers proficient to use ICT in teaching mathematics?

Justification of the Study

Teaching methods are being changed from time to time. In ancient time, Gurukul education system was adopted in which students used to go to guru for certain time of interval and after finishing the education, they used to return from the place, students used to pay dakshina to guru. The system was changed into schooling system in which teacher teaches the students in school. According to the change in time, teaching methods are being changed. The reasons behind changing the teaching methods are learning theories. Learning theories means the theories which describe how people and animals learn. The most still influencing design of instruction today are derived from the 4 main categories of learning theories, i) Behaviorism, ii) cognitivism, iii) social - cognitivism, iv) social critical learning theories. Different learning theories have explained on how learning occurs in students with different principles of learning. Behaviorist claim that learning is change in behavior through repeated practice and drill, cognitivist claim that

learning is change in mental schema and constructivist assume that learning occurs when the learners actively participate at learning process and they involve in social interaction (Acharya, 2072). In this way, different theories have explained about teaching learning.

Similarly, in the 21st century, ICT is being used in teaching learning process as a tool and subject both. All the developed countries have adopted ICT in teaching and learning activities. ICT helps to improve teaching and learning, to develop learners skills considered to be essential in the modern world, to increase motivation for teaching and learning to change the environment of classroom to be more learners centered, to enhance creativity and collaboration, etc. because of being such types of benefits from ICT in teaching, it is being used. So, developing countries are also trying to adopt ICT as tools and subject. Among such countries, our country is one. Different policies have been made, different plans on ICT has been prepared. Development of infrastructure for ICT is going on. By taking different topic/issues related to ICT are being taken for research. Many researches have been completed on ICT. Researcher had reviewed few researches on the topics; attitudes of teachers on ICT, status of ICT use in math's learning and teaching, Geogebra in teaching geometry, Geogebra in algebra etc., but no one had done research on ICT related to teacher's knowledge, skills required for teaching math's. In other hands, teacher is the main person for implementing policies of ICT in teaching field. So, it was necessary to research on the topic. This research may help to

- Formulate policies for ICT teacher training.
- Identify the gap between prepared policies and recent condition of teacher.

Objectives of the Study

The main objectives of this study were as follows:

- To identify the level of competency of mathematics teachers on using ICT applications.
- To compare the confidence level of mathematics teachers on ICT skills in terms of types of schools (institutional and public).
- To compare the confidence level of mathematics teachers on ICT skills in terms of gender (male and female).
- To compare the confidence level of mathematics teachers on ICT skills in terms of level of schools (secondary and basic level).

Hypothesis of the Study

Hypothesis is an assumption or some supposition to be proved or disproved.

Collected information will be changed into numerical form and following hypothesis will be tested. The null and alternative hypotheses for the objectives 2nd, 3rd and 4th are as follows respectively:

a. H₀: There is no significance difference between the competency level of private and public school's mathematics teachers on ICT skills.

H₁: There is significance difference between competency level of private and public school's mathematics teachers on ICT skills.

b. H₀: There is no significance difference between the competency level of male and female mathematics teachers on ICT skills.

H₁: There is significance difference between the competency level of male and female mathematics teachers on ICT skills.

c. H₀: There is no significance difference between the competency level of basic and secondary level mathematics teachers on ICT skills.

H₁: There is significance difference between the competency level of basic and secondary level mathematics teachers on ICT skills.

Delimitation of the Study

The study was delimited under the following ways:

- The study was delimited to the sub-metropolitan Ghorahi, Dang district.
- Questionnaire was only the tool of collecting the data.
- This study was based on the mathematics teachers of school level.
- Conclusion found in this study was based on the information given by teachers through questionnaire only. This study was not based on practical activity.

Operational Definition of Key Terms

ICT: It refers to the applications of computer, mobile and projectors like MS word, MS excel, MS power point, Email, Google, Face book and mathematical software ‘Geogebra’.

Skills: It is defined as knowledge required to use ICT applications like MS Word, Excel, PowerPoint, Email, Google, Face book, mathematical software ‘Geogebra’. The skills are categorized in 4 groups which are given below:

Word Processing: It refers to a group of 3 applications; MS Word, MS Excel, MS PowerPoint (skills like creating new document, open an existing document, format document, change fonts, spell check, insert images, text, page number, add header and footer, print, create tables, change margins and page set up, use columns and sections, set up styles, create new spreadsheet, enter data into an existing spreadsheet, insert calculation, insert and delete rows and column, create graph, apply formula, import and

export data, create slideshow, insert images, add animation and transitions, include sound, print etc.)

Internet: It refers to a group of 3 applications; Email, Google, Face book (skills like access emails, create and send mails, add attachments to email, locate sent and deleted messages, navigate to known websites, do basic searches, save images and text, download and install software, change profile picture, send request, search friend, delete, accept, and block friend, update post, comment on post, delete comment, chat with friend, save picture)

Mathematical software: It refers to only one software Geogebra (skills like download Geogebra, use slider and text, find area of plane figure and slope of line, save file, open existing file, animate figure, construct polygon, prepare teaching module on transformation, vector, co - ordinate geometry, construct 3D figure)

Operating System: It refers to general knowledge of computer like opening and closing computer, refreshing computer, and file navigation.

Competency: It refers to ‘what and how much knowledge teachers have in ICT?’ To measure the competency level, score for each teacher were calculated by assigning ‘0’ for ‘No’ and ‘1’ for ‘Yes’. Competency level was measured in two ways. In first way, competency level of sampled teachers was measured for each skill separately using % and on the basis of the interval (0 - 0.33), (0.34 - 0.67) and (0.68 - 1) as low, medium and high respectively. In second way, total scores of each teacher were calculated and confidence interval for the mean of population was found with the help of Z - value at 0.05 level of significance and competency level of population was identified on the basis

of the interval (0 - 32.33), (32.34 - 64.67) and (64.68 - 97) as low, medium and high respectively which method of interpretation was similar to Alharbi (2014).

Confidence: It refers to ‘how well teacher can use ICT?’ This term was measured by using 5 point Likerts’ scale. Each level of the Likert’s scale were assigned marks. According to the response of teacher, their scores were calculated and there was comparison between teachers in terms of gender, types of schools and level of teachers using t- test at 0.05 level of significance.

Proficiency: It refers to competency level as well as confidence level of teachers.

Teacher: It is defined as a person who is teaching mathematics in school level (1 - 10).

Institutional School: It is defined as a school which is getting financial support from a person or organization under the rule of government.

Public School: Those schools which are getting financial support from government.

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Chapter II

Review of Related Literature

One of the essential preliminary tasks to undertake a research study is to go through existing literature in order to acquaint the available knowledge in the area of interest. The literature review is an integral part of the research process and makes a valuable contribution to almost every operational step (Kumar, 2011).

Generally, literature refers to journal, research reports, books, newspaper, internet publication, thesis, encyclopedia, hands book, yearbook etc. (Khanal, 2073). In this study, lots of literatures have been reviewed. Here few reviews are given below:

Empirical Review for the Study

Shrestha (2015), did a research on the topic “Status of ICT use in teaching and learning mathematics”, with objective to find the use of ICT in mathematics teaching and learning. The study was case study, conducted for a week in which observation and interview were used as major tools for collecting data. 3 mathematics teachers out of 4 and 20 students from class 7, 8, 9 and 10 were taken purposively as the sample for the study. Descriptive and interpretive analysis was used to analyze the data. This research shows that there was neither any plan on the use of educational technology tools in math’s teaching and learning, nor any teachers’ training on the use of educational technologies for mathematics teachers to teach mathematics and there was lack of relevant educational technology tools for schools.

This research indicated that there is no any inadequate teacher’s training on the use of educational technologies. That means, teachers don’t have sufficient knowledge to

use ICT. But the literature didn't show the level of teachers on using ICT. This thing had been found in this study.

Bhandari (2015), studied on "Effectiveness of Geogebra - assisted instruction in mathematics at secondary level" by taking objectives to compare the achievement of students in mathematics by using Geogebra - assisted instruction and taught by tradition methods and to foster students' motivation towards Geogebra - assisted instruction. The research design was experimental research design. 25 students were taken as an experimental group and 23 students as a control group from grade 9 purposively. The experiment was done for 1 week. To get information, researcher had used achievement test and five point Likert scale and to interpret data, t - test at 0.05 level of significance was used. This research shows that the students in the experimental group performed significantly better than students in control group and a five point Likert scale was applied for fostering students' motivation.

Lamichhane (2017), conducted research on "effectiveness of Geogebra on students' achievement in geometry", taking purpose to find the effectiveness of Geogebra software on students' achievement in parallelogram and circle of geometry at grade 10. To achieve the goal, a pre-test and post-test of quasi-experimental research design was used in which 36 students of grade 10 were taken as experimental group and 39 students as a control group conveniently. Mathematics achievement test, a set of questionnaire related to five points Likert scale were used to gather data and gathered data were analyzed and interpret using t-test at 0.05 level of significance. The result of the study was that there was a significant difference between the average achievement score of

experimental and control groups. Additionally, students gave positive feedback or view about Geogebra software in learning parallelogram and circle of geometry.

These above last two studies established dynamic software Geogebra as an effective tool for teaching geometrical lesson but did not show, whether teacher can use Geogebra in teaching geometry or not? which is more concerned subject matter which had been surveyed through this study.

Timilsena (2017), carried out a research on “attitude of teacher toward ICT in teaching mathematics” to find the existing situation and attitude of teachers towards ICT in mathematics teaching. The study is descriptive survey design and the data was gathered by using questionnaire as a tool. Sample was all the mathematics teachers of Surkhet district which was census. The collected data were organized, tabulated, analyzed and interpreted by using statistical tools such as percentage and Chi square test at 0.05 level of significance. The result of the study was that the schools have sufficient ICT tools, teachers have positive opinion towards e - learning, all the teachers and students agreed that the ICT tools are very useful for mathematics achievement.

This research indicated that teachers have positive opinion towards e-learning and agreed that ICT tools are very useful for mathematics achievement. That means they have positive attitude towards using ICT but this literature did not show about the knowledge of teachers on ICT which had been discovered through this study.

Keong (2006) did a research on “A Study on The Use of ICT in Mathematics teaching”, in Malaysia to find the barriers preventing integration and adoption of ICT in teaching mathematics. This research deployed a survey design and data was gathered by using questionnaire as a tool. A total of 111 responses were received and they were

analyzed using statistical package. As a result, the survey found the barriers in using ICT in mathematics, lack of time in the school schedule for projects involving ICT, insufficient teacher training opportunities for ICT, inadequate technical support for these project, lack of knowledge about ways to integrate ICT to enhance the curriculum, difficulty in integrating and using different ICT tools in a single lesson and unavailability of resources at home for the students to access the necessary educational materials.

Hudson and Porter (2010) did a research on “ICT use to improve mathematics learning in secondary school”, to examine the beliefs, attitudes and knowledge of mathematics teachers towards using computer technology and how this translates into teachers using or not using computer in the classroom, in addition the study examined whether or not there were facilitating or inhibiting factors leading to embedding computer use in teaching mathematics, hence improving mathematics learning. The sample contained 114 mathematics teachers from 26 public secondary schools in New South Wales, Australia. The instrument used in this study was a survey questionnaire developed and piloted by the researcher and mailed to secondary schools in the New South Sales Department of Education and Training. The findings of the study indicated that the strongest predictors that are positively associated with computer use are training on Excel and the need for ongoing support for the inclusion of technology in mathematics teaching.

Ghavifkr & Rosy (2015) did a study on “Teaching and learning with technology: Effectiveness of ICT integration in schools”, in Malaysia. This study aims to analyze teachers’ perceptions on effectiveness of ICT integration to support teaching and learning process in classroom. A survey questionnaire was distributed randomly to the total of 101

teachers from 10 public secondary schools. The data for this quantitative research were analyzed for the both descriptive and inferential statistic. The results indicate that ICT integration has a great effectiveness for both teachers and students. Findings indicate that teacher's well-equipped preparation with ICT tools and facilities is one of the main factors in success of technology-based teaching and learning. It was also found that professional development training programs for teachers also played a key role in enhancing students' quality learning.

According to the above last 3 reviews of literatures, teacher's training is necessary to teacher for making them capable to use ICT but these studies had not found the confidence level of teachers on using ICT which had been discovered through this study.

For doing this research, many literatures have been reviewed. Among them, the reviewed of national and international literatures related to the topic have been presented above briefly. From the review, the researcher have got idea about how to start study? how to get information? what types of researches had been completed? how to analyzed data?. It helped to make broad knowledge on ICT. The main thing I got from review is that no one had done research on the topic in Nepal. So, the research was new. Moreover, most of the researches were found to be concentrated on the perceptions and understanding of math's teachers on ICT but no researcher had done research to find the skills of teachers so, the research has own significant. The research found whether teachers were able to use ICT in teaching math or not?

Theoretical Review for the Study

It had been tried out to understand the efforts done in education related to ICT through constructivism. Constructivism is one philosophy which emphasis on the social

questions and interests for worldwide democracy and creation of good society. This philosophy accepts the regular change in society. It takes education as a medium of social changes. The concept of this philosophy is that the problems faced in society should be taken in the way of solution continuously.

Teacher is the person who helps students to connect their prior knowledge to new method of ICT assisted instruction. When teacher assists students for connection, students learn new technology and relate it to what they already know. Without teacher, students cannot learn new technology because they need correction and direction. Teacher's quality is the single most important determinant of the student's performance. This is even more significant when using ICT. The teacher's belief, knowledge and action all affect the success of the learner. Teacher should correct or warrant the knowledge a learner constructs. They must direct the student to provide experiences that can expand upon their previous learning. Teachers must continuously reassure students that they are doing things right, that their thinking has power and their errors are correctable. According to constructivism, teacher is only the helping person for students to create new knowledge in technology based on prior knowledge and to help students, teacher must have the excellent knowledge on ICT. So, this study is related to teacher's knowledge and skills on ICT.

On the basis of cognitive psychology the concept of constructivism has emerged, by means of excluding the results of research by Piaget, Vygotsky and Bruner, achievements of artificial intelligence including: neuron networks, expert systems and databases. In constructivism, it is assumed that knowledge is a construction of human mind, which comes into being as a result of own and diversified activity.

According to Rachele (2014), Constructivism is a philosophy of learning founded on the premise that, by reflecting on our experiences, we construct our own understanding of the world we live in. Constructivism is a theory of learning based on the idea that knowledge is constructed by the knower based on mental activity. Learners are considered to be active organisms seeking meaning but will become increasing more complex, differentiated and realistic as time goes on. Constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their ideas. During infancy, it is an interaction between their experiences and their reflexes or behavior-patterns Constructivist theory of learning is grounded in the educational philosophy. Constructivist is the process those structures of knowledge can be stored in memory and retrieved when needed learning is modification but the important of learning happen inside the head of the individual so constructivist perspective challenge such views of learning.

The main proponents of this theory are John Dewey, Vygotsky and Bruner. John Dewey, a believer in what he called "the audacity of imagination," was one of the first national figures in education policy. He rejected the notion that schools should focus on repetitive, rote memorization. Instead he proposed a method of "directed living" in which students would engage in real-world, practical workshops in which they would demonstrate their knowledge through creativity and collaboration. Students should be provided with opportunities to think from themselves and articulate their thoughts.

Lev Vygotsky (1896 - 1934), known for his theory of social constructivism, believes that learning and development is a collaborative activity and that children are cognitively developed in the context of socialization and education. The perceptual,

attention, and memory capacities of children are transformed by vital cognitive tools provided by culture, such as history, social context, traditions, language, and religion. For learning to occur, the child first makes contact with the social environment on an interpersonal level and then internalizes this experience. The earlier notions and new experiences influence the child, who then constructs new ideas.

Vygotsky's theory is one of the foundations of constructivism. It asserts three major themes regarding social interaction, the more knowledgeable other, and the zone of proximal development. Social interaction plays a fundamental role in the process of cognitive development. In contrast to Jean Piaget's understanding of child development (in which development necessarily precedes learning), Vygotsky felt social learning precedes development. He states: "Every function in the child's cultural development appears twice: first, on the social level, and later, on the individual level; first, between people (inter psychological) and then inside the child (intra psychological)". The MKO refers to anyone who has a better understanding or a higher ability level than the learner, with respect to a particular task, process, or concept. The MKO is normally thought of as being a teacher, coach, or older adult, but the MKO could also be peers, a younger person, or even computers. The ZPD is the distance between a student's ability to perform a task under adult guidance and/or with peer collaboration and the student's ability solving the problem independently. According to Vygotsky, learning occurred in this zone. Vygotsky focused on the connections between people and the sociocultural context in which they act and interact in shared experiences. According to Vygotsky, humans use tools that develop from a culture, such as speech and writing, to mediate their social environments. Initially children develop these tools to serve solely as social

functions, ways to communicate needs. Vygotsky believed that the internalization of these tools led to higher thinking skills (David L, 2014).

A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based upon their current/past knowledge. The learner selects and transforms information, constructs hypotheses, and makes decisions, relying on a cognitive structure to do so. Cognitive structure (i.e., schema, mental models) provides meaning and organization to experiences and allows the individual to “go beyond the information given”.

Some philosophical premises of constructivism are given below;

- Change is continuous process; in each and every field, change is necessary continuous process according to the time and condition. Among such field, education is one in which change is needed. In worldwide context, teaching methods are being changed continuously but in our country it has not been. Only traditional methods are being used. To make change in teaching method, ICT is to be used in teaching which is supported by this philosophy.
- Future can be better than the present; if we give continuity to the present without any change, we cannot get better future than present. So, we have to be changed in present for making better future. Similarly, teacher should adopt the use of ICT in teaching in present for getting better result in education.
- Emphasis on democratic system; Traditional teaching methods are autocratic that means teacher is the major person in teaching learning, he forces to the students for doing what he say. Students cannot do anything themselves. Students are not allowed to use their thought, their skills in learning. But constructivism is in

opposition of such methods. Students are free to learn themselves. They are allowed to use their skill, thought in learning. For making teaching democratic, creative, ICT is helpful.

- Education is a mean for social change; in broad sense, this earth is like a family. Each family member is allowed to know about other member. For this ICT is very useful. One person can see all the activities of the world from a place through ICT. Students can learn knowledge which is in the world. So, in our country, ICT is necessary to make people for adjusting in the worldwide society.

Above premises support to ICT in mathematics. So, constructivism had been taken to analyze the study. This research found that whether teachers were ready to use constructivism in teaching or not, what types of knowledge they had? This had been found.

Conceptual Framework

Miles and Huberman (1994) defined a conceptual framework as a visual or written product, one that “explains, either graphically or in narrative form, the main things to be studied-the key factors, concepts, or variables and the presumed relationships among them”.

According to constructivism, teacher themselves must be creative. Teacher should adopt the teaching methods given by constructivism to make class constructive. Students create knowledge themselves by interaction with people of society. Now a days, world has been one society because of being rapid development in ICT. So, to adjust in the society education system should be integrated with ICT. One person can learn one thing by different methods through ICT from different places. To make students able to adjust

in the society, they must be taught using ICT. For this, teacher must be able to use ICT at first. So, this research was done to find whether teachers are able to use ICT or not?

Whether they had ICT skills or not?

The topic of this study ‘Proficiencies of math’s teacher on ICT ’was studied in four keys which are shown in the following table:

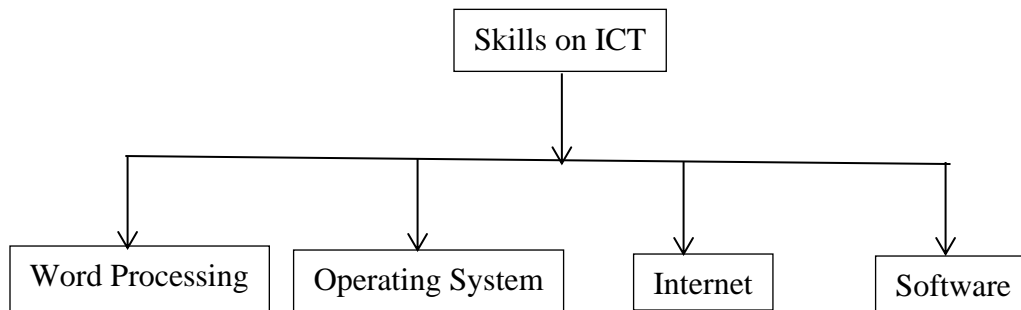


Figure I: Conceptual Framework of the study

Above skills are the basic for using ICT. In this study under MS word, creating and opening document, format a document, change fonts, spell check, insert text, insert page number, add headers/footers, print, insert images, create tables, change page set up. Change margins, use columns and sections were sub skills. Sub skills of file navigation were to save files in a selected folder, to create and name new folders, to copy, delete and rename files, to install software, to navigate between existing folders, to select and navigate between drives and directories, to navigate between networks. Sub skills of power point were to create a new slide show, to edit an existing slide show, to insert images, to change font and layout, to add animation and transitions, to insert hyperlinks, to use master slide functions, to include sounds, to print handout, to add navigation button. Sub skills of excel were to create a new spreadsheet, to enter data into an existing spreadsheet, to insert some calculations, to format cells, to sort cells, to insert and delete

rows and columns, to create new charts, to modify existing chart, to use filtering, to refer to multiple worksheet. Sub skills of email were to create and send email, to add address book entries, to locate, sent and delete messages, to store messages in folders, to add attachments on emails, to add a signature to emails, to create a mailing list, to set up a discussion list. Sub skills of internet were to navigate known websites, to create favorites or bookmarks, to do basic searches, to use advanced search tools, to save images and text, to download and install software. All these sub skills were given to mathematics teachers through questionnaire and they had to give answer whether they were able to do above work or not.

Chapter III

Research Methodology

Research methods are the ways of conducting the study to fulfill the objectives, so methods are the most important part of the research. The chapter consists of research design, population of the study, sample and sampling procedure, tool for data collection, data collection procedure, data analysis and interpretation procedure.

Research Design

A research design is a systematic plan to study a scientific problem. Research design is the framework that has been to seek answers to research questions. There are different research designs. Among them descriptive survey design is one of the famous and most used design. The word ‘survey’, as per Merriam Webster Dictionary is derived from Anglo French word ‘surveer’ which means to look over. Further, according to the dictionary, survey means a) to examine as to condition, situation, or value-appraise; b) to query (someone) in order to collect data for analysis of some aspect of a group or area; c) to determine and delineate the form, extent and position of (as a tract of land) by taking linear and angular measurements and by applying the principles of geometry and trigonometry; d) to view or consider comprehensively; and e) to inspect, scrutinize (Mathiyazhagan, T., & Nandan, D., 2010).

This research was related to find the teachers’ knowledge and skills on ICT. The main objective of the study was to find out the level of math’s teacher on ICT skills i.e. whether the math’s teachers had skills to use ICT or not. For that the best research design was survey design because it is used to gather more information. It is useful in describing the characteristics of a large population. It has a strong preference for large random

sample because it provides a most accurate estimate of what is true in the population. No other research method can provide this broad capability, which ensures a more accurate sample to gather targeted results in which to draw conclusions and make important decisions. So, survey design was used in the study as best design.

Population and Sample of the Study

All the mathematics teachers of Ghorahi sub metropolitan, Dang district were taken as the population of the study. There were 42 secondary schools (15 public and 27 private) altogether. One third schools (5 public and 9 private) were chosen randomly as sample schools using lottery method. There were about 45 teachers in 14 selected schools. Among them, 31 were male and 14 were female.

Tool for Data Collection

One important work in research is data collection which collects needed information and evidences for taking conclusion. There are many tools for data collection in survey. Among them one tool, questionnaire which helps to gather primary data, was used to collect the information from teachers.

Questionnaire. A questionnaire is a data collection instrument consists of a series of questions and other prompts for the purpose of gathering information from respondents. A questionnaire should allow us to collect the most complete and accurate data in a logical flow. A well-designed questionnaire should meet the research goal and objectives and minimize unanswered questions a common problem bound to many surveys.

This research was done to identify the competency and confidence level of mathematics teachers on ICT for checking whether they were able to use ICT in teaching

mathematics or not. So, for getting primary information or first - hand information, questionnaire had been taken as tool to collect information. For finding competency of teachers, the questionnaire had consisted of closed type of questions level. Questions were separated in 4 groups. The groups were as follows;

Word Processing. It refers to a group of 3 applications: MS Word, MS Excel, MS PowerPoint (skills like creating new document, open an existing document, format document, change fonts, spell check, insert images, text, page number, add header and footer, print, create tables, change margins and page set up, use columns and sections, set up styles, create new spreadsheet, enter data into an existing spreadsheet, insert calculation, insert and delete rows and column, create graph, apply formula, import and export data, create slideshow, insert images, add animation and transitions, include sound, print etc.)

Internet. It refers to a group of 3 applications; Email, Google, Facebook (skills like access emails, create and send mails, add attachments to email, locate sent and deleted messages, navigate to known websites, do basic searches, save images and text, download and install software, change profile picture, send request, search friend, delete, accept, and block friend, update post, comment on post, delete comment, chat with friend, save picture)

Mathematical software. It refers to only one software Geogebra (skills like download Geogebra, use slider and text, find area of plane figure and slope of line, save file, open existing file, animate figure, construct polygon, prepare teaching module on transformation, vector, co-ordinate geometry, construct 3D figure)

Operating System. It refers to general knowledge of computer like opening and closing computer, refreshing computer, and file navigation.

Also, for identifying the confidence level of teachers on using ICT applications, the questionnaire consisted of 5 points Likert's scale. The questionnaire is given in appendix XIII.

Validity of Tool

To ensure the good quality of the tool, validity was more important, what it means that the test must have the test items which truly achieve the objectives. Validity of the tool was established by the help of subject teacher, expert and supervisor. Also pilot test was administered among 7 teachers of one school and from their responses, some corrections were made.

The reliability is an internal consistency of a test while validity is consistency with external criteria. The extent to which it gives consistent result is testing and retesting is known as reliability (Freeman, 1965).

Data Collection Procedure

Data collection procedure means the way of gathering information from selected sample. The way of collecting data is called data collection procedure. The processes of collecting information for this research were given as; at first researcher visited the sampled school and met with administration and asked permission. Then after he met to mathematics teachers, informed them about the purpose of the questionnaire, provided the questionnaire to them and requested them for providing their valuable responses. Researcher made clear on the statements when they found any difficulty. Finally, thanking to all the respondents and school authorities of all schools' administration for

their kind co-operation. For some private schools, friends who were teaching in the schools were used to collect data from their school's teachers. One week time period was given to the teachers for filling the questionnaire and after the time, researchers and gone to the respective schools and get back the questionnaire. In this way data were collected.

Data Analysis and Interpretation Procedure

Data analysis is considered to be important step in research work. After collection of data with the help of relevant tools and techniques, the next logical step is to analyze and interprets data with a view to arriving at empirical solution of problem (Singh, 2009, as cited in Timilsina, 2017).

The level of ICT use among teachers is considered to be the basis for identifying the degree of ICT skills they possess and can implement across the curriculum, or in ICT itself. In order to determine the level of ICT usage among teachers, arithmetic means and percentage regarding ICT skills were calculated. To measure the competency level of teachers, score for each teacher were calculated by assigning '0' for 'No' and '1' for 'Yes'. Competency level of teachers on ICT was measured in two ways. In the first way, competency level of sampled teachers was measured for each skill using mean, percentage and the arbitrary level using the interval (0 - 0.33), (0.34 - 0.67) and (0.68 - 1) as low, medium and high respectively. In second way, total scores of each teachers were calculated and confidence interval for the mean of population was found with the help of Z - value at 0.05 level of significance and competency level of the population was identified on the basis of the intervals (0 - 32.33), (32.34 - 64.67) and (64.68 - 97) as low, medium and high respectively (Alharbi, 2014). In this study, the collected data through questionnaire were changed into numerical form. The collected data were analyzed and

interpreted by using different statistical devices such as mean, standard deviation, variance, confidence interval and t-test. Mean and percentage were calculated to obtain level of math's teachers on skills. The t-test was used at 0.05 level of significance to find whether or not the significance difference between level of private and public schools mathematics teachers, and male and female mathematics teachers on ICT skills.

Chapter IV

Analysis and Interpretation of Data

In this section, collected information through questionnaire are analyzed and interpreted. Analysis and interpretation of data is one backbone as well as heart of any research which helps to give conclusion of study. This study is related to find proficiencies of mathematics teachers on ICT. To find their competency level on ICT, basic skills were listed and two options yes and no were given. Teachers having the skills had ticked on yes option and teachers not having the skills had ticked on no option. For finding confidence level of teachers on ICT, five points Likert's scale were given. Options were very low, low, medium, high and very high. To analyze the data, collected data are changed into numerical form. To change the data into numerical form, '1' score was given for 'Yes' and '0' score was given for 'No'. Similarly, 1, 2, 3, 4 and 5 scores were assigned to very low, low, medium, high and very high respectively.

To find the competency level of teachers on ICT, average and percentage of every skill were calculated and given arbitrary level (low, medium, high) by using the scale: low for 0 - 0.33, medium for 0.34 - 0.67 and high for 0.68-1. Also, the scores of each teacher were calculated and confidence interval for the mean of population was found with the help of z-value at 0.05 level of significance and competency level of the population was identified by using the scale (0 - 32.33) for low, (32.34 - 64.67) for medium and (64.68 - 97) for high. Similarly, in Likert's scale, scores of each teacher were calculated, mean and standard deviation was found. Finally, using t - test at 0.05 level of significance, conclusion had been found.

In this section, just collected data were analyzed and interpreted in 3 bullets which are as below:

- Background information of teachers
- Competency level of mathematics teachers on ICT
- Confidence level of mathematics teachers on ICT

Background Information of Teachers

There were 42 secondary schools in Ghorahi sub metropolitan Dang. Among them 15 were public and 27 were private. From 27 private and 15 public schools, 9 private and 5 public schools respectively were sampled randomly using lottery method. From total 14 sampled schools, data were collected from 45 mathematics teachers. Among them 25 were from private and 20 were from public schools. 31 were male and 14 were female. 20 were secondary teachers and 25 were basic level teachers. 11 teachers had taken basic level training in computer. One teacher was from BSC (CSIT). About 40% teachers were from other subject (like physics, chemistry, BSC CSIT, MBS) except mathematics.

Competency of Mathematics Teachers on ICT

Basic ICT skills were classified into 4 groups which are word processing, operating system, internet and mathematical software. MS word, MS excel, MS PowerPoint were kept in the group of word processing. Email, Google and Face book were kept in the group of internet. Only one famous most used mathematical software Geogebra was taken in the group of mathematical software. Data were analyzed and interpreted separately on the basis of groups as follows:

Table I: Level of Teacher's in ICT Applications

ICT applications	Average scores	Level
Operating system	0.76	High
MS Word	0.77	High
MS Excel	0.47	Medium
MS PowerPoint	0.47	Medium
Email	0.39	Medium
Google	0.48	Medium
Face book	0.94	High
Geogebra	0.15	Low

Above table shows that the level of teachers in the ICT applications (operating system, MS Word, Face book) was high with average scores 0.76, 0.77, 0.94 respectively. Similarly, in the MS Excel, MS PowerPoint, Email and Google, teacher's level was medium with average scores 0.47, 0.47, 0.39 and 0.48 respectively. And in mathematical software (Geogebra), teacher's level was low with average scores 0.15. The highest level of teachers was in Face book application and lowest level of teachers was in Geogebra software.

Operating System. From the table given in appendix I, 88% of teachers can open and close computer, 86% of teachers can refresh computer, save files in a selected folder, create and name new folder, copy, delete and rename files. 66% of teachers can navigate between existing files. 57% of teachers can install software, navigate into network, select and navigate between drives and directories. The average score of teachers in the skills of

operating system was 0.76 which lies in (0.67 - 1). So, the level of teachers in operating system was high.

MS Word. From the table given in appendix II, 82% of teachers can create document, change fonts, insert images, create tables and average scores for each skill was 0.82 which was in high level. 80% of teachers can format document, insert text and change margins and average scores for each skill was 0.8 which was in high level. More than 70% teachers can spell check, insert page number, add headers and footers, print, change page set up, use columns and sections which were in high level. 68% of teachers can set up styles. Average score of teachers for the skills in MS Word was 0.77 which lies in (0.68-1). So, level of teachers in MS Word was high.

MS Excel. From the table given in appendix III, (60 - 65)% of teachers can create new spreadsheet, enter data into an existing spreadsheet, insert and delete rows and columns, create new charts which were in medium level. 55% of teachers can insert some calculation, format cells and sort cells with average 0.55 which were also in medium level. 48% of teachers can modify existing charts with average 0.48 which was in medium level. 35% of teachers can apply complex formulae, use absolute and relative cell references and refer to multiple worksheets with average 0.35 which lie in medium level. 37% of teachers can import and export data with medium level. 33% of teachers can use filtering and use conditional formatting in which teacher's level was low. Average score of teachers for the skills of MS Excel was 0.47 which lies in (0.34 - 0.67). So, teachers were in medium level in MS Excel.

MS PowerPoint. From the table given in appendix IV, (50 - 57)% of teachers can create a new slideshow, edit an existing slideshow, insert images, change font and layout,

add animation and transitions, include sound in which teachers level was medium. 46% of teachers can navigate back and forth during a presentation, print handout which also lie in medium level. (35 - 37)% of teachers can insert hyperlinks, create an original master, use master slide functions, add navigation button. Average score of teachers for the skills of MS PowerPoint was 0.47 which lies in (0.34 - 0.67). So, teacher's level in MS PowerPoint was medium.

Email. From the table given in appendix V, 51% of teachers can create and send emails with average 0.51 which was in medium level. (40 - 48)% of teachers can access emails, locate sent and deleted messages, store messages in folders and add attachments to emails in which they have medium level. 35% and 37% of teachers can access and use address book entries and add to address book entries respectively. Teachers had low level of skill to add a signature to email, create a mailing list and set up a discussion list. Average score of teachers for the skills of email was 0.39 which lies in (0.34 - 0.67). So, the level of teachers in Email was medium.

Google. From the table given in appendix VI, (75 - 80) % of teachers can navigate to known websites, do basic searches, save images and text which were in high level. The levels of teachers to create favorites or bookmarks (42%), use advanced search tools (37%), organize favorites or bookmarks (35%), download and install software and plug-ins (40%) were medium. Similarly, the levels of teachers to alter browser preferences (28%), conduct complex searches (28%) were low. The average score of teachers for the skills of Google was 0.48 which lies in (0.34 - 0.67). So, the level of teachers in Google was medium.

Facebook. From the table given in appendix VII, teachers had high level in all skills of face book. More than 90% of teachers can change profile picture, send friend request, search friend, delete friend request, accept the friend request, block or unfriend, update post, share newsfeed, comment on any post, delete comment on any post, chat with friend, save pictures. Average score of teachers in the skills of face book was 0.94 which lies in (0.68-1). So, the level of teachers in face book was very high.

Geogebra. From the table given in appendix VIII, the levels of teachers to download Geogebra (15%), use slider (15%), use text (15%), use button and check box (15%), find area of plane figure (15%), find slope of line (15%), save Geogebra files (15%), open existing Geogebra file (15%), animate figure (15%), construct circle , different types of polygon (17%), prepare teaching module for transformation (15%), for vector (13%), for co - ordinate geometry (15%), make visualization of theorem with figure (15%), construct 3D figures (15%) were low. Average score of teachers for the skills of Geogebra was 0.15 which lies in (0 - 0.33). So, the level of teachers in Geogebra was very low.

In this way, the competency level of sampled teachers was identified skill wise. But it was necessity to analyze the competency level for whole population which is given below:

Table II: Result of Confidence Interval for μ

	Value
Number of teachers	45
Mean	53.87
Standard deviation	26.97

Level of significance	0.05
Z-value	1.96
Confidence interval	(45.99 - 61.75)

The above table II shows that there were 45 mathematics teachers. Through questionnaire the response of teachers on ICT skills were gathered and total score of each teacher was calculated. The mean and standard deviation of the scores obtained by 45 teachers were 53.87 and 26.97 respectively. Since the confidence interval for μ was (45.99 - 61.75) which lies in the interval (32.34 - 64.68). So, the competency level of the whole population was medium at 0.05 level of significance.

Comparison of the Confidence Level of Mathematics Teachers on ICT in Terms of Private and Public Schools

In appendix IX, the score of mathematics teachers of private and public schools in the confident level are presented. The summary of statistical calculation for the comparison is given in table III below:

Table III: Result of the Comparison in Terms of Types of School

	Teachers of	
	Private schools	Public schools
Number of teachers	25	20
Mean	50.76	36.95
Standard deviation	18.13	11.75
Variance	328.70	138.06
F	2.38	

Calculated t-value	2.94
Tabulated t-value	1.96

The above table III shows that there were 25 private and 20 public mathematics teachers. Through questionnaire confident level of teachers was gathered using five points Likert's scale and for each confident level score was given and for each teacher, score had been found and the scores has been given in appendix IX. The mean score of mathematics teachers of private and public schools are 50.76 and 36.95 respectively as well as variances are 328.7 and 138.06 respectively. Also standard deviation of the teachers of private and public schools were 18.13 and 11.75 respectively. These values were calculated using Microsoft Office Excel 2007. Since the value of F was 2.38 which was less than the tabulated value 2.45 of F, so both groups were homogeneous, hence the method of pooled variance for t - test was applied. Here tabulated t - value at $\alpha = 0.05$ level of significance for two tailed test with 43 degree of freedom is 1.96 but calculated t - value was 2.94. Here $2.94 > 1.96$, so that H_0 was rejected and H_1 was accepted. Hence there is significance difference in the confident level of mathematics teachers in terms of private and public schools.

Comparison of Confidence Level of Mathematics Teachers in ICT in Terms of Gender

The scores for confident level of mathematics teachers in terms of gender are given in appendix X and the summary of statistical calculation for both gender male and female is represented in the table IV below,

Table IV: Result of the Comparison in Terms of Gender

	Male teachers	Female teachers
Number of teachers	31	14
Mean	47.58	38.07
Standard deviation	18.50	10.72
Variance	342.25	114.92
F	2.98	
Calculated t - value	2.17	
Tabulated t - value	1.96	

The above table IV shows us, there were 31 male and 14 female teachers. The scores for confident level of teachers on ICT in terms of gender were given in appendix X. The mean, standard deviation and variance of male teachers were 47.58, 18.50 and 342.25 respectively. Similarly, the mean, standard deviation and variance of female teachers were 38.07, 10.72 and 114.92 respectively. Since the value of F is 2.98 which was greater than tabulated value 2.83 of F, so that the two groups of male and female were not homogeneous therefore t-test for unequal variance was applied. Here tabulated t-value at $\alpha = 0.05$ level of significance for two tailed test with 40 degree of freedom is 1.96 and calculated t-value was 2.17. Since $2.17 > 1.96$, so, H_0 was rejected and H_1 was accepted. Hence it is concluded that there is significance difference between the confidence levels of teachers in ICT skills in terms of gender. Thus, male and female were not equal in confident level.

Comparison between the Confidence Levels of Mathematics Teachers in ICT in Terms of Level of Schools

The scores for confident level of mathematics teachers in terms of level of schools, secondary level and basic level teachers have been given in appendix XI and summary of statistical calculation for secondary and basic level mathematics teachers in confident level is given in table V below,

Table V: Result of Comparison in Terms of Level of Schools

	Secondary level teachers	Basic level teachers
Number of teachers	20	25
Mean	47.95	41.96
Standard deviation	18.29	15.66
Variance	334.52	245.24
F	1.36	
Calculated t-value	1.18	
Tabulated t-value	1.96	

Above table V shows us that there were 20 secondary and 25 basic level mathematics teachers. The scores for confident level of mathematics teachers in ICT were represented in appendix XI. The mean, standard deviation and variance of secondary level teachers were 47.95, 18.29 and 334.52 respectively. Similarly, the mean, standard deviation and variance of basic level mathematics teachers were 41.96, 15.66 and 245.24 respectively. Since the value of F is 1.36 which was less than the tabulated value 2.34 of F, so that the two groups of secondary and basic level mathematics teachers

were homogeneous therefore t-test for pooled variance was applied. Here tabulated t-value at $\alpha = 0.05$ level of significance for two tailed test with 43 degree of freedom was 1.96 but calculated t - value was 1.18. Since $1.18 < 1.96$, so H_0 was accepted. Hence it was concluded that there is no significance difference between the confident level of mathematics teachers in ICT in terms of level (secondary and basic).

Chapter V

Summary, Findings, Conclusion and Recommendations

This chapter consists of a brief summary of the study, major findings drawn from the study after the analysis of collected data, conclusion and recommendations for future studies.

Summary of the Study

The research entitled “Proficiencies of Mathematics Teachers on ICT” was intended to explore the level of mathematics teachers on ICT skills and to compare the confidence level of mathematics teachers on ICT in terms of gender, level of schools and types of schools. There were 3 pairs of null and alternative hypotheses. For the data collection of this study, pilot test was conducted on 7 teachers of the school Great Buddha Secondary School, Ghorahi-10, Dang and on required place, questions were reformed. Questionnaire was used to collect data. Population of this study was taken to all the mathematics teachers of Ghorahi sub metropolitan, Dang district. The sample schools were selected randomly using lottery method. There were 43 secondary schools (15 public and 28 private schools). Among them 14 (one - third) secondary schools (5 public and 9 private) were taken as samples.

To analyze the data, collected data through questionnaire were changed into numerical and mean, percentage and confidence interval for mean of population at 0.05 level of significance were calculated to obtain the level of mathematics teachers on ICT skills. Similarly, t - test was used at 0.05 level of significance to find whether or not the significance difference between the confidence level of private and public schools

mathematics teachers, male and female mathematics teachers and secondary and basic level mathematics teachers.

Conclusively, this study has shown that the competency level of mathematics teachers on ICT skills is medium. There is significance difference between the confidence level of mathematics teachers on ICT skills in terms of types of schools (private and public) and gender (male and female). But there is no significance between the confidence level of mathematics teachers on ICT skills in terms of level of schools (Basic and secondary level).

Findings of the Study

For finding the level of teachers in ICT skills, skills were given to tick yes or no in questionnaire. On the basis of their responses, teacher's skills were classified in 3 levels as high, medium and low by calculating average score and percentage. Similarly, for comparing the confidence level of teachers on ICT skills, five points Likert's scale was given and their responses were scored in numerical form. For testing the hypotheses, calculated and tabulated t-values were compared. Also mean, standard deviation, variance, calculated and tabulated t-value, calculated value of F were recorded in table for analyzing teacher's confidence level in ICT.

Following were the findings of the study;

- The average score for the application Operating system is 0.76 which lies in the interval (0.68 - 1). So, the competency level of teachers in Operating System was high.

- The competency level of teachers in Word Processing was medium, being the average score for the application Word Processing 0.57 which lies in the interval (0.34 - 0.67).
- The average score for the application Internet is 0.60 which lies in the interval (0.34 - 0.67). So, the competency level of teachers in Internet was medium.
- The competency level of teachers in mathematical software 'Geogebra' was very low since its average score 0.15 lies in the low interval (0 - 0.33).
- The competency level of the population was medium because confidence interval for the mean of population at 0.05 level of significance was (45.99 - 61.75) which lies in the medium interval (32.34 - 64.68).
- There was no significance difference between the confidence level of basic and secondary level's mathematics teachers on ICT skills i.e. confidence level of teachers on ICT was not different according to qualification. Since t - test at 0.05 level of significance has shown that average scores for both groups are same, very closed.
- There was significance difference between the confidence level of male and female mathematics teachers on ICT skills i.e. the average score for confidence level of male teachers was higher than that of female teachers because average score for male (47.58) is greater than that of female (38.07).
- There was significance difference between the confidence level of private and public school's mathematics teachers on ICT skills i.e. average score for confidence level of private school's teachers was higher than that of public

school's teachers. Since the average score for the private schools teachers (50.76) is greater than that of public Schools (36.95).

Conclusion

From the above findings of the study, it is concluded that most of the teachers have skills to use MS Word, Operating System and Face book. Teachers have high level of skills related to MS Word, Operating system and Face book. They have medium level of skills on MS Excel, PowerPoint, Email and Google. But they have low level of skills on Geogebra. Comparatively, teachers are more capable to use MS Word but less in Email. They don't have skills to use Geogebra software which is related to mathematics. The confidence level of basic and secondary level mathematics teachers was approximately equal. On the basis of average scores, the confidence level of male teachers was higher than that of female teachers. The confidence level of private school's mathematics teachers was higher than that of public school's mathematics teachers.

Overall teachers had medium level of ICT skills. There was significance difference between the confidence level of mathematics teachers on ICT skills in terms of gender and types of schools but not with the level of qualification. Teachers had basic knowledge on ICT but not sufficient to integrate it into classroom. For preparing teachers ready to integrate ICT in teaching learning activities, special training has been needed. They are using internet for just entertainment. Only few are using in searching subject matter required for teaching. Orientation program related to internet should be given which may help teachers about 'how to use internet in teaching?' For mathematics teachers, the training related to mathematical software has been needed. Time has been changing. Day by day, student's interest, necessities are also changing, teaching methods

are also changing but our teachers are not changed. Still they are using traditional method. To change the classroom into ICT integrated, at first teachers should be trained and regular observation of teachers must be done for checking whether they are using ICT in teaching or not. Finally from above discussion, it is concluded that teachers don't have sufficient knowledge on ICT. So, training has been must wanted to them.

Recommendations

From the findings of this study, the researcher suggests the following recommendations:

Recommendations for the Educational Implication

- MOE and NCED should encourage the teacher to learn and use ICT in teaching learning activities by organizing various training and orientation programs, workshops, conferences etc.
- MOE should be able to introduce the new pedagogies which are based in educational technology.
- ICT tools should be incorporated in teacher education curriculum.
- Curriculum of school level mathematics should be reform such that the curriculum may relate the subject matter with practical work, ICT tools (mathematical software Geogebra).
- Practical marks should be separated for using ICT in learning geometrical concept and regular observations should be done for effective evaluation.

Recommendation for Further Studies

This research shows that teacher's level in ICT skills is medium and there is significance difference between the confidence level of mathematics teachers in ICT in

terms of gender and types of schools but not according to qualification of teachers. Only this research can't occupy all areas of research. Research is one important task which finds something new. In the time interval of this study, different topics have been realized as important for research. Some topics are suggested for further research as recommendation as below:

- Comparison between the ICT level of mathematics teachers and students of secondary level.
- Uses of ICT in teaching field.
- Interest of teachers using ICT tools in teaching field according to age.

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Appendices**Appendix - A****Level of Teachers on Operating System**

Skills	Scores	Average	percentage	level
Open computer	40	0.88	88%	High
Close computer	40	0.88	88%	High
Refresh computer	39	0.86	86%	High
Save files in a selected folder	39	0.86	86%	High
Create and name new folder	39	0.86	86%	High
Navigate between existing folders	30	0.66	66%	Medium
Copy, delete and rename files	39	0.86	86%	High
Select and navigate between drives and directories	26	0.57	57%	Medium
Navigate into a network	26	0.57	57%	Medium
Install software	26	0.57	57%	Medium
Total		7.57		
Average		0.76		High

Appendix - B**Level of Teachers on MS Word**

Skills	Scores	Average	Percentage	Level
Create a new document	37	0.82	82%	High
Open an existing document	37	0.82	82%	High
Format a document	36	0.8	80%	High
Change fonts	37	0.82	82%	High
Spell check	33	0.73	73%	High
Insert text	36	0.8	80%	High
Insert page number	35	0.77	77%	High
Add headers/footers	34	0.75	75%	High
Print	33	0.73	73%	High
Insert images	37	0.82	82%	High
Create tables	37	0.82	82%	High
Change page set up	33	0.73	73%	High
Change margins	36	0.8	80%	High
Use columns and sections	32	0.71	71%	High
Set up styles	31	0.68	68%	High
Total		11.6		
Average		0.77		High

Appendix - C**Level of Teachers on MS Excel**

Skills	Scores	Average	Percentage	Level
Create new spreadsheet	28	0.62	62%	Medium
Enter data into an existing spreadsheet	27	0.6	60%	Medium
Insert some calculations and Format cells	25	0.55	55%	Medium
Sort cells	25	0.55	55%	Medium
Insert and delete rows and columns	29	0.64	64%	Medium
Create new charts(graphs)	27	0.6	60%	Medium
Modify existing charts(graphs)	22	0.48	48%	Medium
Apply complex formulae	16	0.35	35%	Medium
Use absolute and relative cell references	16	0.35	35%	Medium
Refer to multiple worksheets	16	0.35	35%	Medium
Use filtering	15	0.33	33%	Low
Use conditional formatting	15	0.33	33%	Low
Import and export data	17	0.37	37%	Medium
Total		6.12		
Average		0.47		Medium

Appendix - D**Level of Teachers on MS PowerPoint**

Skills	Scores	Average	Percentage	Level
Create a new slideshow	26	0.57	57%	Medium
Edit an existing slideshow	25	0.55	55%	Medium
Insert images	26	0.57	57%	Medium
Change font and layout	23	0.51	51%	Medium
Can navigate back and forth during a presentation	21	0.46	46%	Medium
Add animation and transitions	26	0.57	57%	Medium
Insert hyperlinks	17	0.37	37%	Medium
Create an original master	16	0.35	35%	Medium
Can use master slide functions	16	0.35	35%	Medium
Include sound	24	0.53	53%	Medium
Print handout	21	0.46	46%	Medium
Add navigation button	16	0.35	35%	Medium
Total		5.64		
Average		0.47		Medium

Appendix - E**Level of Teachers on Email**

Skills	Scores	Average	Percentage	Level
Access emails	22	0.48	48%	Medium
Create and send emails	23	0.51	51%	Medium
Access and use address book entries	16	0.35	35%	Medium
Add to address book entries	17	0.37	37%	Medium
Locate sent and deleted messages	21	0.46	46%	Medium
Store messages in folders	20	0.44	44%	Medium
Add attachments to email	18	0.4	40%	Medium
Add a signature to email	14	0.31	31%	Low
Create a mailing list	15	0.33	33%	Low
Set up a discussion list	13	0.28	28%	Low
Total		3.93		
Average		0.39		Medium

Appendix - F**Level of Teachers on Google**

Skills	Scores	Average	Percentage	Level
Navigate to known websites	34	0.75	75%	High
Create favorites or bookmarks	19	0.42	42%	Medium
Do basic searches	36	0.8	80%	High
Use advanced search tools	17	0.37	37%	Medium
Organize favourites or bookmarks	16	0.35	35%	Medium
Alter browser preferences	13	0.28	28%	Low
Save images and text	35	0.77	77%	High
Conduct complex searches	13	0.28	28%	Low
Download and install software and plug-ins	18	0.4	40%	Medium
Use different browsers	21	0.46	46%	Medium
Total		4.88		
Average		0.48		Medium

Appendix - G**Level of Teachers on Facebook**

Skills	Scores	Average	Percentage	Level
Change profile picture	43	0.95	95%	High
Send friend request	43	0.95	95%	High
Search friend	43	0.95	95%	High
Delete friend request	43	0.95	95%	High
Accept the friend request	43	0.95	95%	High
Block or unfriend	41	0.91	91%	High
Update post	43	0.95	95%	High
Share news feed	43	0.95	95%	High
Comment on any post	43	0.95	95%	High
Delete comment	42	0.93	93%	High
Chat with friends	43	0.95	95%	High
Save picture	43	0.95	95%	High
Total		11.34		
Average		0.94		High

Appendix - H**Level of Teachers on Geogebra**

Skills	Scores	Average	Percentage	Level
Download geogebra	7	0.15	15	Low
Use slider	7	0.15	15	Low
Use text	7	0.15	15	Low
Use button, check box	7	0.15	15	Low
Find area of plane figure	7	0.15	15	Low
Find slope of line	7	0.15	15	Low
Save geogebra file	7	0.15	15	Low
Open existing geogebra file	7	0.15	15	Low
Animate figure	7	0.15	15	Low
Construct circle, different types of polygon	8	0.17	17	Low
Prepare teaching module for transformation	7	0.15	15	Low
Prepare teaching module for vector	6	0.13	13	Low
Prepare teaching module for co-ordinate geometry	7	0.15	15	Low
Make visualization of theorem with figure	7	0.15	15	Low
construct 3D figures	7	0.15	15	Low
Total		2.25		
Average		0.15		Low

Appendix - I

Scores for Confidence Level of Male and Female Mathematics Teachers

S.N.	Scores of Male Mathematics Teachers	Scores of Female Mathematics Teachers
1	22	48
2	31	36
3	68	20
4	59	42
5	33	46
6	63	28
7	57	36
8	33	36
9	40	48
10	66	38
11	49	38
12	42	33
13	40	61
14	61	23
15	48	
16	78	
17	48	
18	90	
19	83	
20	39	
21	29	
22	37	
23	40	
24	23	
25	21	
26	31	
27	62	
28	44	
29	22	
30	50	
31	66	
	$\bar{x}_1 = 47.58, S_1^2 = 342.25, S_1 = 18.5$	$\bar{x}_2 = 38.07, S_2^2 = 114.92, S_2 = 10.72$

Appendix - J**Scores for Confident Level of Private and Public School's Mathematics Teachers**

S.N.	Scores of Private School's Mathematics Teachers	Scores of Public School's Mathematics Teachers
1	22	28
2	31	36
3	48	39
4	68	36
5	59	48
6	33	38
7	63	38
8	57	33
9	66	29
10	36	37
11	33	61
12	40	40
13	66	23
14	49	21
15	42	23
16	20	31
17	42	62
18	40	44
19	61	22
20	48	50
21	78	
22	48	
23	90	
24	83	
25	46	
	$\bar{x}_1 = 50.76, S_1^2 = 328.69, S_1 = 18.13$	$\bar{x}_2 = 36.95, S_2^2 = 138.06, S_2 = 11.75$

Appendix - K**Scores for Confidence Level of Basic and Secondary Level's Mathematics Teachers**

S.N.	Secondary Level's Mathematics Teachers	Basic Level's Mathematics Teachers
1	57	22
2	66	31
3	40	68
4	66	59
5	42	33
6	61	63
7	48	33
8	48	49
9	90	40
10	83	78
11	39	37
12	29	23
13	40	62
14	21	48
15	31	20
16	44	42
17	50	28
18	22	36
19	36	36
20	46	48
21		38
22		38
23		33
24		61
25		23
	$\bar{x}_1 = 47.95, S_1^2 = 334.52, S_1 = 18.29$	$\bar{x}_2 = 41.96, S_2^2 = 245.24, S_2 = 15.66$

Appendix - L**Statistical Formula Used in Data Collection and Analysis Procedure**

S.N.	Subject	Notation	Formula
1	Mean	\bar{x}	$\frac{\sum x}{n}$
2	F - distribution	F	$\frac{S_1^2}{S_2^2}$
3	Pooled Variance	S_p^2	$\frac{(n_1 - 1)S_1^2 + (n_2 - 1)S_2^2}{n_1 + n_2 - 2}$
4	t - distribution for equal variances	T	$\frac{\bar{x}_1 - \bar{x}_2}{sp \sqrt{\frac{1}{n_1} + \frac{1}{n_2}}}$
5	Degree of freedom (equal variances)	df	$N_1 + N_2 - 2$
6	Degree of freedom (unequal variances)	df	$\frac{\left(\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}\right)^2}{\frac{\left(\frac{S_1^2}{n_1}\right)^2}{n_1 - 1} + \frac{\left(\frac{S_2^2}{n_2}\right)^2}{n_2 - 1}}$
7	t - distribution for unequal variances	T	$\frac{\bar{x}_1 - \bar{x}_2}{\sqrt{\frac{S_1^2}{n_1} + \frac{S_2^2}{n_2}}}$

Appendix - M

Questionnaire

Dear Valued Respondents

Research is one of the difficult work which finds something new. To complete the work, I would like to request to you for filling the questionnaire with correct information.

As you are working as the mathematics teacher, your responses to this survey will be very helpful for this research. This research is related to the teacher's ICT skills. You have to give the information about what type of skills you have and what is confident level by ticking in appropriate option. I thank you for giving the time and cooperation to answer this survey which will help to complete the research of master's degree in mathematics education from Central Department of Education, T.U., Kirtipur, Nepal.

Your comments are very important. Please take few minutes now to fill this out.

Why should I fill in this survey?

It's researcher request to you. This information helps to the researcher for writing thesis of master degree.

Who should answer the question?

Only the mathematics teacher of basic and secondary level.

Are my answers confidential?

The survey is being carried out among many teachers across the sub metropolitan Ghorahi, dang and you have been selected at random. Your answers will be kept completely confidential. The results will be aggregated and will not identify any individual or school.

How do I answer the question?

For all questions, you need to do is tick which most applies to you. Please read all the questions carefully and follow the instructions after each question.

Thank you very much

Q. 1 In what type of school do you work?

- a. Public
- b. Private

Q. 2 Please indicate the level that apply to you?

- a. Basic
- b. Secondary

Q. 3 Gender:

- a. Male
- b. Female

Q. 4 year of experiences (write year of teaching).....

Q. 5 Your academic qualification.....

Q. 6 Have you taken any type of training on ICT? If you have taken training, what type of training you have got? Mention below.

.....

ICT Skills

Listed in this section are various ICT skills relating to different software applications. The skills range from basic to advance ICT skills.

Do you have following skills? If you have, tick on yes and if no, tick on no.

Q.4. With operating system (windows explorer, file navigation)

Skills	Response	
	Yes	No
Open computer		
Close computer		
Refresh computer		
Save files in a selected folder		
Create and name new folder		
Navigate between existing folders		
Copy, delete and rename files		
Select and navigate between drives and directories		
Navigate into a network		
Install software		

Q5. Word processing

i. In MS word,

Skills	Response	
	Yes	No
Create a new document		
Open an existing document		
Format a document		
Change fonts		
Spell check		

Insert text		
Insert page number		
Add headers/footers		
Print		
Insert images		
Create tables		
Change page set up		
Change margins		
Use columns and sections		
Set up styles		

ii. In MS Excel,

Skills	Response	
	Yes	No
Create new spreadsheet		
Enter data into an existing spreadsheet		
Insert some calculations		
Format cells		
Sort cells		
Insert and delete rows and columns		
Create new charts(graphs)		
Modify existing charts(graphs)		

Apply complex formulae		
Use absolute and relative cell references		
Refer to multiple worksheets		
Use filtering		
Use conditional formatting		
Import and export data		

iii. In MS PowerPoint,

Skills	Response	
	Yes	No
Create a new slideshow		
Edit an existing slideshow		
Insert images		
Change font and layout		
Can navigate back and forth during a presentation		
Add animation and transitions		
Insert hyperlinks		
Create an original master		
Can use master slide functions		
Include sound		
Print handout		
Add navigation button		

Q. 6. Internet

i. In email,

Skills	Response	
	Yes	No
Access emails		
Create and send emails		
Access and use address book entries		
Add to address book entries		
Locate sent and deleted messages		
Store messages in folders		
Add attachments to email		
Add a signature to email		
Create a mailing list		
Set up a discussion list		

ii. In Google,

Skills	Response	
	Yes	No
Navigate to known websites		
Create favorites or bookmarks		
Do basic searches		
Use advanced search tools		
Organize favourites or bookmarks		

Alter browser preferences		
Save images and text		
Conduct complex searches		
Download and install software and plug-ins		
Use different browsers		

iii. In Facebook,

Skills	Response	
	Yes	No
Change profile picture		
Send friend request		
Search friend		
Delete friend request		
Accept the friend request		
Block or unfriend		
Update post		
Share news feed		
Comment on any post		
Delete comment		
Chat with friends		
Save picture		

If you have used other internet service, please mention

below.....

Q7. Mathematical Software

I. With Geogebra,

Skills	Response	
	Yes	No
Download Geogebra		
Use slider		
Use text		
Use button, check box		
Find area of plane figure		
Find slope of line		
Save Geogebra file		
Open existing Geogebra file		
Animate figure		
Construct circle, different types of polygon		
Prepare teaching module for transformation		
Prepare teaching module for vector		
Prepare teaching module for co-ordinate geometry		
Make visualization of theorem with figure		
construct 3D figures		

If you have used other software, please mention below.

.....

ICT Confidence Level

Above skills are specific. But in this section, general skills are listed. Teachers are given 5 options to choose one which is appropriate. Just tick (√) on one which is best for you.

S.N.	Skills	Very low	Low	Medium	High	Very high
1.	Basics of operating PC (using keyboard, mouseetc.)					
2.	Managing files (delete, move to,...etc.)					
3.	Using word processor (such as word program)					
4.	Using spreadsheet processor (such as excel program)					
5.	Using PowerPoint software					
6.	Searching for saved data on hard disk or computer disk					
7.	Using different designing program (Photoshop, flash)					
8.	Deleting or editing pictures, animations or movies					

9.	Internet browsing					
10	Searching for information on the internet					
11	Downloading files from internet					
12	Using email (reading and sending mails)					
13	Using chat rooms and forums (Facebook, twitter)					
14	Using Google					
15	Constructing plane figure in Geogebra					
16	Constructing 3D figure in Geogebra					
17	Preparing attractive teaching module in Geogebra					

Thank you so much for providing time and co - operation.