EFFECTIVENESS OF GEOGEBRA IN TEACHING GEOMETRY

A

THESIS

BY

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Letter of Certificate

This is certified that Mr. Chandramani Bohara, a student of academic year 2072/073 B.S with the exam Roll No 7228268, Campus Roll No. 138, Thesis No.1410 and T.U Registration No. 9-2-322-88-2009 has complete his thesis under the supervision of Mr. Abatar Subedi, during the period prescribed by the rules and regulation of Tribhuvan university, Nepal. The thesis entiled **"Effectiveness of GeoGebra in Teaching Geometry"** embodies the result of his investigation, conducted during the period 2019 in the Deparnment of Mathematics Education, Tribhuvan University, Kritipur, Kathmandu. I recommended and forward that this thesis be submitted for the evaluation to awarding the degree of Master Education.

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LETTER OF APPROVAL

This thesis entitled **"Effectiveness of GeoGebra in Teaching Geometry"** submitted

by Mr. Chandramani Bohara in partial fulfillment of the requirement for the Master's

Degree in Education has been approved.

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December, 2019

पौष,२०७६

Recommendation for Acceptance

This is to certify that Mr. Chandramani Bohara has completed his M. Ed. thesis

entitled **"Effectiveness of GeoGebra in Teaching Geometry"** under my supervision

during the period prescribed by 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. Abatar Subedi)

Deecember, 2019   Supervisor

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Dedication

This work is dedicated to my parents Shasila Bohara and Jhuplal Bohara who were eagerly waited this achievement.

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.

…………………………

(Chandramani Bohara)

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Abstract

The purpose of this study was to investigate effectiveness of GeoGebra in teaching geometry at grade IX. The effectiveness was measured by comparing achievement of the students taught by using GeoGebra and without using GeoGebra software and explain the student's perception in teaching geometry by using GeoGebra software. It is a quantitative research including experimental research design. The researcher selected two government schools; One for experimental groups and another for control group. There were 27 students for experimental group and 29 students were for control groups. Two groups were taught the same topic of geometry during one month. The researcher used pre-test and post-test non-equivalent experimental design. The experimental group was taught by using GeoGebra software and control group was taught by using traditional method. Mathematics achievement test was conducted on both groups to collect data for this research. A set of questionnaire based on five point Likart scale was used to experimental group to measure the perception towards GeoGebra software. The collected data were analyzed by comparing mean, S.D and t-test with the help of SPSS software.

The result of this study shows that achievement of the students in experimental group has better than that of control group. Also from the result of questionnaire shows that positive perception towards GeoGebra software in teaching geometry. It is concluded that GeoGebra software is useful tool in teaching mathematics at secondary level.

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Acronyms

C.G.   :   Control Group

E.G.   :   Experimental Group

ICT   :   Information and Communication Technology

NCF   :   National Curriculum Framework

NCTM   :   National Council of Teachers of Mathematics

CDC   :   Curriculum Development Center

YNN   :   Yamuna Nanda Namuna

TJSS   :   Tribhuvan Janta Secondary School

SPSS   :   Statistical Package of Social Science

Chapter I

Introduction

Background of the Study

Information and Commutation Technology (ICT) refers to use new or modern technology in any field. ICT creates the environment for the learner to learn easily from difficulty. Worldwide researches have shown that ICT can lead to improve student's learning with appropriate teaching method. It provides great opportunity for teacher and learner to improve their teaching and learning process.

Mathematics education is the base for scientific development. Mathematics subject result found weakness than another subject from the different research. This subject thought as the difficulty subject in the world and many students afraid from this subject. In the context of Nepal a lot students felling as the difficulty subject to mathematics at school level. More of the students are failure in this subject. It is accepted by teacher and parents. Here must be practice in mathematics to use different ICT tool to avoid the felling difficulty of students from this subject and teaching learning activity must be visualized by different mathematical software at school level. Here are different mathematical software for teaching mathematics as GeoGebra, mathematica, matlab etc. Much of the students have felt difficulty in geometrical content in mathematics at school level. GeoGebra is the most important mathematical software which visualizes the geometric concept with figure. So, I selected this topic effectiveness of GeoGebra in teaching geometry at school level. I analyzed the result of this study after than use of GeoGebra on my research of this study.

The use of ICT in teaching mathematics can make the teaching process more effective as well as enhance the students' capabilities in understanding basic concepts. Nevertheless, implementing its use in teaching is not without problems as numerous barriers may arise. The types of barriers have been identified in the study (Keong, Horani & Daniel, 2005). This states that if we use of different ICT tool in teaching mathematics, students take clear concept about related content and they can remember for long time. Also, Use of ICT in mathematics teaching makes effective and increases student achievement.

The use of ICT material in education has played effective role. The teaching pedagogy has been changed which depend on ICT. There are multicultural learner at the school level. All students have not same capacity to learn, so ICT tools helps for the learner to learn different dimension. ICT focus on the student achievement from quantity to quality. The teaching learning activity must be learner centered approach needed, so ICT material creates the environment for the learner with their aspection. Therefore ICT bring changes in the classroom teaching and students learn the knowledge with felling undifficulties. Students need different teaching skill to be successful in today's, in which class ICT material is used. This helps to the learner for learning and memorization.

GeoGebra is attempt to join two pillar geometry and algebra; it also design for educational purpose and can help students to foster their mathematical learning (Hohenwarter and Printer, 2007). GeoGebra is open sources software with rapidly growing worldwide Popularity. It allows educators to create interacting learning environment to foster experimental and discovery learning for students while visually interacting with geometry, algebra, calculus and statistics. It is power full tool for teaching mathematics teacher.

In the various field, there are using different ICT material. As the same way, ICT material are using in teaching field. In teaching mathematics GeoGebra is an important teaching material which gives easy and clear concept understanding interface. Geogebra is dynamic mathematical software international areas for all levels education that brings together geometry, algebra, spreadsheets, statistics and calculus. It is created by Markus Hohenwarter in 2001 as the part of his master thesis in mathematics education and computer science at the university of Salzburg in Austria. It is effective tool for both teacher and students.

Statement of the Problem

The use of technology has played important role in education. Different research has shown ICT as effective tool for teaching and learning at school level. In the different country use of ICT is rapidly groth. It is believed that ICT is most important factor for integrating the developing and developed countries. But use of ICT in Nepal has slown progress in the field of education. The government of Nepal, ministry of education , national information and communication technology policy (2015), shows different guide lines and goals about information and communication technology policy. Moreover, in the context of Nepal school education is based on traditional approach. Less of school have access of ICT tool. Few mathematics teacher can't use of ICT in the classroom at school level. Tradition of paper pencil medium has made difficulty to learn geometry for the students at school level.

Now days,different software are developed related to different subject and content. As the same ways, many software developed related to teaching and learning mathematics, like mathematica, GeoGebra, graphic calculator etc. These software helps to teaching and learning mathematics. Among them GeoGebra is most

important tool for teaching mathematics. It is easy to use for the teacher and makes interesting in teaching geometry. In the context of Nepal few mathematics teacher only known about use of Geoebra but many teacher does not know how to use GeoGebra in teaching mathematics at school level.

If we teach geometry by using GeoGebra with visualizing the different figure, then students take clear concepts in geometry. The review of different literature shows that GeoGebra is effective teaching material which has positive impact on student's achievement for learning mathematics at school level. Therefore, we defined that GeoGebra gives meaningful learning, it facilitates a lot of contents of the Basic and Higher Education of Mathematics. GeoGebra creates the interactive geometry environment for 2D and 3D. But from the literature review, less numbers of researcher research on effectiveness of GeoGebra triangle and parallelogram. So this study is conducted effectiveness of GeoGebra software in teaching geometry and it helps to the teaching learning process for the teacher and students in geometry. The main gave of this study has described achievement of the student on experimental group with consistency. Also experimental area and content have taken different from another research. This study is useful for the study of GeoGebra software in theorem related triangle and parallelogram in teaching geometry at grade IX.

Significance of the Study

More students think mathematics as the difficulty subject for the study. The achievement of mathematics result is poor in different data of school level. The teacher and parents accept this fact about school education. So mathematics teacher must be careful for the teaching environment and student psychology. Mathematics subject has been taught as a compulsory subject in school education from grade I to X

in the context of Nepal. The use of ICT is increasing day by day in different field. So mathematics teaching should be ICT based.

This study would be helpful for researcher, mathematics teacher, student and policy maker. The finding of this study shows how technology facilities teaching and learning in geometry by using GeoGebra. This study helps to prepare plans for teacher and curriculum designer where are different abilities. It provides an opportunity to compare the views of students and helps to develop that use of ICT at school level.

This study explore about ICT tool at school level. The use of GeoGebra in Geometry teaching helps to visualize the geometrical concepts and this study would help to motivate the students and teacher in teaching and learning process. The use of GeoGebra in geometry teaching could help to increase student's performance of mathematics and it helps to include teacher, students and parents.

This study encourages for school administrators to manage the dynamic mathematical software like as GeoGebra. Furthermore this research helps to another researcher about use of GeoGebra software and other students, participants and researcher get a lot of help for their professional and carrier development in their life.

Objectives of the Study

The main objective of this study was to find effectiveness of GeoGebra in teaching triangle and parallelogram at grade IX. This has accomplished by the following objectives.

- To compare achievement of the student's in geometry taught by using GeoGebra and without using GeoGebra.
- To explain students perception in teaching geometry by using GeoGebra.

Hypothesis of the Study

Hypothesis are the assumption about the population, that assumption are may or may not be true. It helps the researcher to find expectation of the research study.

Research hypothesis. GeoGera based teaching is better than traditional method. The research hypothesis is concern that using GeoGebra is effective in teaching geometry on the topic triangle and parallelogram than traditional method.

Statistical hypothesis. The null and alternative hypothesis were formulated as

H_0: There is no significance difference between achievement score in geometry of experimental group and control group. i.e H_0: $\mu_1 = \mu_2$

H_1: There is significance difference between achievement score in geometry of experimental group and control group. i.e H_1: $\mu_1 \neq \mu_2$

Research Questions

The following research questions were constructed to complete objective in this study.

- Is there significance difference in achievement of the students in geometry with using GeoGera and not using GeoGera ?
- What are the perceptions of the students in teaching geometry with using GeoGebra ?

Delimitation of the Study

This study was limited the following areas.

- This Study was conducted in two government school of Rukum.

- This study was based on compulsory mathematics of grade IX.

- The experimental period of this research was one month in two public school.

- The experimental group was taught by using GeoGebra and control group was taught by traditional method.

- This study was based on experimental research design.

- Pre-test, post-test and questionnaire was used for the data collection in this study.

Operational Definition of the key Terms

This part of the study helps to ensure detail description of the different word. Operational definition should be made before the collection of data in the research study. The key terms of this study were defined as the following ways.

Traditional Method. After chosen the any school teaching process without using technology (GeoGebra) in this study.

Experimental Group. The group of the students where used GeoGebra software regularly while teaching triangle and parallelogram at grade IX.

Control Group. The groups of the students where facilated the students by teacher on the topic triangle and parallelogram by traditional method. There is not use any technology.

GeoGebra. It is free dynamic mathematical software which can be used to support teaching and learning from school level to university level. It explore wide variety of algebraic concept through graph and charts.

Effectiveness. This measures the improvement in average achievement of student's and positive perception of the students towards GeoGebra software. Also, it identified active participation of the students in treatment group.

Chapter II

Literature Review

Review of literature guides and helps to the researcher for the complete of the objective of the study. A literature review is a written summery of journal, articles, books and other document that describes the post and current states of information on the topic of research study. So much information available searching and locating good on the topic of research study can be challenging (Creswell, 2012). Thus review of related literature involves systematically identifying locating and analyzing covering our chosen topic. This chapter represents the empirical literature, theoretical literature and conceptual framework of the study.

Empirical Review

I reviewed some national and international thesis, journal and articles which are described in the following paragraphs.

Paudel (2007) Conducted a study on the topic " A study on the effectiveness of Geoboard in teaching geometry at primary level". The purpose of the study was to compare the achievement of the students taught by using Geoboard with the achievement of the students taught without Geoboard. The researcher selected treatment and control group for this study among them 25 students were for treatment group and 20 students were for control group. Mean, median, standard deviation, variance and t-test were used for analysis of the data. Questionnaire, pre-test, post-test were used for data collection. On the basis of actual classroom, the researcher found the treatment group result was better than control group.

Also, Acharya (2015) studied on "Effectiveness of GeoGebra software on mathematics achievement". The objective of the study was to compare achievement of the student in mathematics of the student in mathematics by using GeoGebra and to elite perception in in learning circles using GeoGebra. The researcher selected two secondary school of the Kathmandu district for experimental group and control group. Out of 53 students of two schools 28 students were for experimental group and 25 were for control group of the class nine. The researcher was used GeoGebra dynamic software tool for one week. Pre-test, post-test and questionnaire were data collection tool. The researcher used mean, variance, standard deviation and t-value for the analysis of the data. The result of that study indicated that student in experimental group have better achievement than control group.

Moreover, Bhandari (2015) studied on "Effectiveness of GeoGebra assigned instruction in mathematics at secondary level". The main objective of the study was to find effectiveness of GeoGebra assigned instruction on students achievement on the topic reflection and rotation at secondary level. The researcher selected experimental and and control group for the study. Out of 48 students 25 students were for experimental group and 23 students were control group. Also the researcher used mean and standard deviation for the analysis of the data. After the analysis of the data the result of experimental group shows better achievement than control group. Also the experimental group students were more motivated where taught by using GeoGebra.

Review of these three literature shows that use of ICT material in teaching mathematics at school level have important role. Students are interested to learn and they can remember for long time which they have studied. These studies shows that ICT based learning result is better than traditional method.

Lamichhane (2017) has published the thesis on the topic " Effectiveness of GeoGebra on student's achievement in geometry". The purpose of the study was to investigate the effectiveness of GeoGebra software on student achievement in parallelogram and circle of geometry at grade 10. The researcher was used experimental design to complete of the objective of the issue. The researcher selects two groups of the student which are experimental group and control group. The researcher chose 75 students from the two school among them 36 students for experimental group and 39 students for control group. The researcher was used mean, variance and standard deviation to analyze and interpretation of the data. After analyzing the data that the experimental group performed better than control group.

Similarly, Barai (2017) had done a research in GeoGebra on the topic "perception of student on the use of GeoGebra in geometry teaching ". The objective of the study was to explore the perception, participation and motivation of students on the use of GeoGebra in geometry teaching at secondary level. The researcher had chosen 22 students of class nine for experimental group. The researcher used mixed method for research design. For the data collection, the researcher used questionnaires including Likart type five point scales. Mean and standard deviation were used for analyze quantitative data and used thematic method used for qualitative data. After the data analysis, the researcher concluded students has positive perception towards using GeoGebra in geometry teaching at secondary level of Nepal.

Moreover, Bist (2017) Conducted a study " Use of GeoGebra in geometric construction ." The purpose of the study was to compare achievement of students taught by using GeoGebra and traditional method and explore student's attitudes to the use of GeoGebra in geometric construction. The researcher was selected two public school for experimental and control group. The researcher was used mean,

standard deviation and t-test for analysis for the collected data. Pre-test, post-test and questionnaire was used for the data collection. After the data analysis, the researcher was found better achievement of the students in experimental groups than control groups.

Also, Joshi (2017) Conducted the study to determine "student's achievement in trigonometry teaching through GeogGebra". The purpose of the study was to investigate the impact of student's achievementin teaching trigonometry through using GeoGebra software. The reasearcher was adopted the quasi experimental design. Experimental group and control group are selected for the study, among them 20 students were for experimental group and 22 students were for the control group. The researcher use mean, standard deviation and t-test for the analysis of data. After analysis of the data, GeoGebra based instruction is much better than traditional way of instruction.

Review of these last four literature shows that the using GeoGebra in teaching and learning geometry increases the student achievement. It has many possibility to help students to get an intuitive felling and to visualize the different shapes in teaching geometry. The use of GeoGebra software tools allows to the students make the connection between symbolic and visual representation and it facilitates a lot of content in mathematics education. GeoGebra based learning is better than traditional method of teaching and learning.

Mukiri (2012) studied on "Feasibility of using GeoGebra in to the teaching learning of geometry concepts in secondary school". The objective of the study was to access the applicability of GeoGebra in in teaching mathematics kajiado country, Kenya. The design for this study was mix method design of qualitative and

quantitative approaches. This study was also compared the change the girls

performance with that boys after being introduced to geometry using GeoGebra. The

study samples were two boys secondary school, two girls secondary school and two

mixed secondary school in Kajado. After the analysis of the data the gender difference

were not seen to after performance of students in mathematics after learning in

GeoGebra environment.

Similarly, Aydos (2015). investigated on the topic "The impact of teaching

mathematics with GeoGebra on conceptual understanding". The purpose of the study

was to investigate the impact of teaching limits and continuity topics in GeoGebra

supported environment on student's conceptual understanding. The researcher selected

experimental and control group for the study. The research design included pre-test

and post-test for the analysis of the data and data were analyze with t-test on gain

score for control and experimental groups. Also researcher used mean, median and

standard deviation for the analysis of the data. Furthermore, the study found that

student's attitudes towards learning mathematics through technology improved, as

well. The researcher concluded that GeoGebra may be effective tool for teaching

learning process.

From review of these last two literature it is concluded that the students has

positive perception towards GeoGebra in teaching geometric lesion. Both studies

states ICT plays important role in teaching mathematics and states there is not gender

difference in perception through using GeoGebra. Shows that the both studies, it is

open sources software and is easy to facilitate the geometric concept to the teacher.

Martinez (2017) studied on "The effects of using GeoGebra on students

achievement in secondary mathematics". The purpose of the study was to determine

students achievement of the students teaching through using GeoGebra in mathematics at secondary level. The researcher selected two groups experimental and control group for the study. Among them Out of 50 students, 28 students were for experimental group and 22 were for control group. The researcher used quasi experimental quantitative research with pre-test and post- test design. The researcher used mean and standard deviation for the data analysis. After the analysis of the data, the researcher concluded that the achievement of the student's with teaching GeoGebra is better than other students.

Similarly, Belgheis & Kamalludeen (2018), was published the journal of educational technology on the topic "Teacher intention to use GeoGebra in the teaching mathematics among Malaysian teachers". There were examined about teacher perception towards using GeoGebra in teaching mathematics. There was investigated intention difference between male and female teacher. The purpose of the study was to explore teacher intention to use GeoGebra in the classroom teaching mathematics based on their current competencies. This study was used cross – sectional survey quantitative analysis method. The numbers of participants were 132 and they were mathematics teacher who have participated in GeoGebra workshop at some points during their teaching career. The data were gathered via of online survey. Response were using obtained using a five point Likart scale ranking from 1 to 5(Strongly Disagree, Disagree, Undecided, Agree, Strongly Agree). The totals of 132 survey responses were collected. There were 76 female and 56 male. The researcher had used mean and standard deviation to interpretation the data. After that observation there was not significance difference between male and female about intention to use of GeoGebra in teaching mathematics.

Here above last two reviews established the mathematical course taught by using GeoGebra is effective for learning process. In this research, the researcher indicates GeoGebra visualizes the connection of different shapes with geometry in secondary level. After the analysis of the data both studies show that achievement of the students based on GeoGebra is better than traditional method.

In summary, from the different review of literature shows that GeoGera is effective tool for learning and experimental group has better result than control group. It has found effective tool for teacher and students in teaching and learning process. It crates interesting environment for learner. Much researcher research about effectiveness of GeoGebra in secondary level but less number of researcher research on the topic triangle and parallelogram. Thus this study is related about effectiveness of GeoGebra in teaching geometry at grade Ix on the topic triangle and parallelogram.

Theoretical Framework of the Study

All studies are based on different theoretical concept. Learning theory provide us with conceptual frame work of the study. Teacher and student are included in teaching learning process. The learners are having different ability in the classroom. Teaching methods are based on different learning theories. This study is based on constructivist approach of learning. Constructivism is branch of philosophy that relates with how learner constructs knowledge and by the constructivism learners are more active. It focus that learning is process where learner actively construct their own knowledge.

Constructivism seems to be use distinguish the constructivist from the traditionalist. Many critics say that the label constructivist teaching is used by many author as more to any teaching that is somewhat " child centered " carrying inclusive

based inequiry (Megraw & Baker, 2007). This statements show they concluded learning is process of activity that is individual to learner and knowledge is actively constructed by learner.
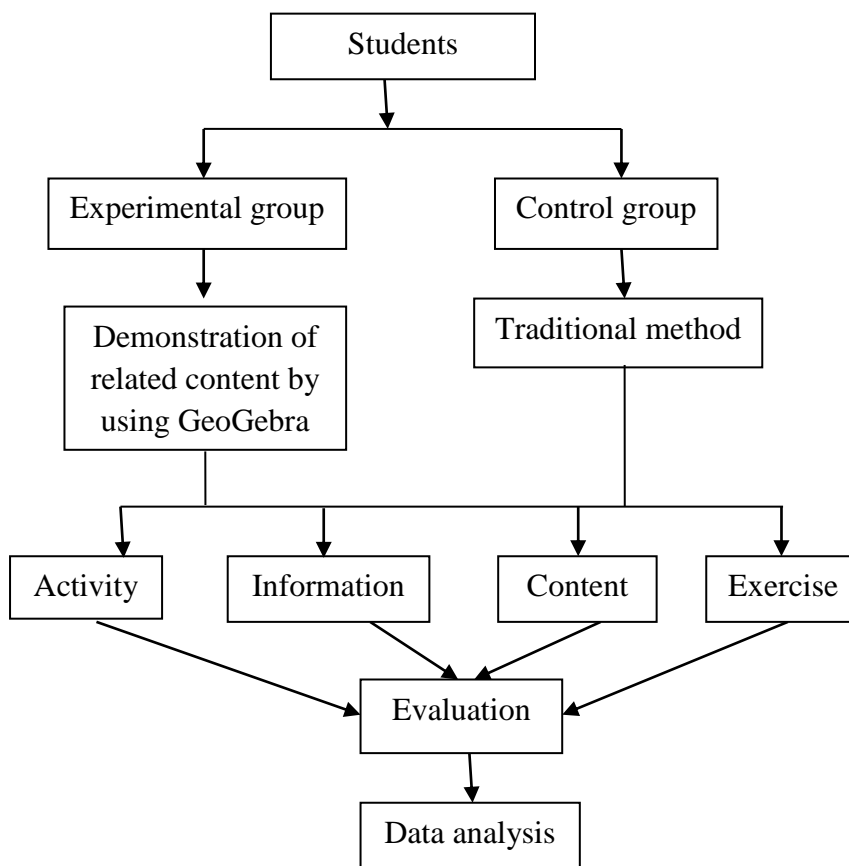
In the learning process.

"Constructivism encourages instructors. Constructivist teachers encourage students to constantly assess how the activity is helping them gain understanding. By questioning themselves and their strategies, students in the constructivist classroom ideally become "expert learners." This gives them ever-broadening tools to keep learning. With a well-planned classroom environment, the students   learn how to learn. You might look at it as a spiral. When they continuously reflect on their experiences, students find their ideas gaining in complexity and power, and they develop increasingly strong abilities to integrate new information. Teacher's main role becomes to encourage this learning and reflection process (Bhattacharjee,2015,p.71)."

This statements states that learner are active construct the knowledge teacher role is instructor in teaching and learning process. About constructivist approach to teaching Glassford(1955) states that It is not internally established. Knowledge is always being created and built by learner. Coming to know is course of action based on learner constant to the experience of the world. This shows students creates the knowledge self actively in learning process and they adjust with content and learning environment.

Conceptual framework of the Study

Conceptual framework helps to the researcher to conduct activity in the field of selected study. The experimental and control group was included the researcher in this study. The researcher was focused the experimental group students where uses GeoGebra software in teaching process. The conceptual framework of this study has shown in the following figure.

Figure: 2.1

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                        ┌──────────────┐
                        │   Students   │
                        └──────────────┘
                ┌────────────────┴────────────────┐
        ┌────────────────────┐          ┌──────────────────┐
        │ Experimental group │          │  Control group   │
        └────────────────────┘          └──────────────────┘
                  │                               │
        ┌────────────────────┐          ┌──────────────────┐
        │  Demonstration of  │          │ Traditional method│
        │  related content by│          └──────────────────┘
        │   using GeoGebra   │
        └────────────────────┘
      ┌──────────┬──────────┐        ┌──────────┬──────────┐
  ┌────────┐ ┌────────────┐    ┌──────────┐ ┌──────────┐
  │Activity│ │Information │    │ Content  │ │ Exercise │
  └────────┘ └────────────┘    └──────────┘ └──────────┘
                    ┌────────────────┐
                    │   Evaluation   │
                    └────────────────┘
                    ┌────────────────┐
                    │ Data analysis  │
                    └────────────────┘
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The students was taught by traditional method to control group and using GeoGebra software to experimental group. The researcher concerned activity, information, content, exercise and presents activity based on specific topic. The researcher was demonstrated different visualizing shape related to course content in the experimental group. The student was motivated and got opportunity to experimental group. Finally the researcher was conducted assessment of the student of the both group and was evaluated students attitude towards use of GeoGebra in experimental group of the students.

The researcher selected students of two government and was defined treatment groups and control group for this research study. The experiment was taught by using GeoGebra and demonstrated the different content related shapes by using GeoGebra. The control group was taught by using traditional method and any ICT tool was not used. The researcher selected the content of mathematics at secondary level and same content was used for both group recommended by CDC from government of Nepal. Further content was included with the permission of supervisor and subject teacher. The information is required to any content which helps researcher and subject teacher to complete educational objectives. The information of subject content was gathered by using GeoGera to the experimental group at grade IX. The researcher concerned activity, information and exercise based on specific content. Teaching activity was conducted on both groups with using same topic and teaching method was used different of both groups. Finally, achievement test was conducted on both groups to evaluate the achievement of the students. The perception of the student's towards GeoGebra software was measured by using attitude scale on experimental group only. At last, collected data was analyzed for final study.

Chapter III

Methods and Procedures

Methodology refers how to collect the data for our research that guides us to conduct the research study. This chapter contains the method and procedures where we were going to conduct the study. Furthermore this chapter contains design of the study, sample of the study, tools, data collection procedure and way of data analysis.

Design of the Study

Research designs are divided into three categories which are quantitative, qualitative and mixed research. Among them this study is related to quantitative research design. The purpose of this study was to investigate effectiveness of GeoGebra in teaching geometry at grade IX. For this, researcher was selected the topic triangle and parallelogram at grade IX. The researcher used quantitative research design. This study was based on experimental research design as quasi experimental design where pre-test, post- test nonequivalent design was used. The data was collected by using questionnaire and achievement test. Experimental and control group were involved in this study and achievement was analyzed at the end of the study. The follows table shows the different group and that was describe the following ways.

Table I: Design of the study

Group	Pre-test	Treatment	Post-test
Experimental	O_1	Using GeoGebra	O_2
Control	O_3	Traditional method	O_4

In this design O_1 and O_3 represent the pre -test and O_2 and O_4 represents the post- test . Same topic was selected of both groups and the control group was taught by traditional method and experimental group was taught by using GeoGebra software.

Independent and Dependent Variable

In this study the researcher used dynamic mathematical software GeoGebra as the independent variable and in teaching mathematics at grade IX on the topic triangle and parallelogram. The dependent variable was presented as the achievement of the students in triangle and parallelogram as well as the perception of the students. Tuition classes, teaching materials, school environment and activeness towards teaching were supposed extraneous variables.

Sample and Population of the Study

All the students of grade IX have taken the population in this study. But due to the lack of time and resources, this cannot study in whole population. Thus, researcher selected two government school of Rukum (West) Yamunananda Namuna Secondary school with 27 students for experiental group and Trihuvan Janta Secondary school with 29 students for control groups. After the pre-test, experimental and control group had selected by lottery procedure. The researcher taught same topic of Geometry as triangle and parallelogram on both groups.

Data collection Tools and Techniques

In this study, Two instrument questionnaire and mathematics achievement test was used for the purpose of data collection. Also quantitative type data collection tool were used in both groups. All data were collected on the basis of quantitative

research design based on quasi experimental design as pre-test post-test non-equivalent group design was used in this study. Pre-test and post-test was conducted on experimental and control group. For the mathematics achievement test question, the piloting test was used to ensure the selected questions and was used split half method to find out reliability of the question. Five point Likart scale was used to measure perception of students about GeoGebra software. SPSS 16.0 was used to analyzed and interpret the data.

Achievement test. The pre-test was conducted on both group to determine the achievement level of the students. Same question was used in the experimental and control groups. The piloting test was conducted to ensure the question for pre-test and post-test. The researcher checked the test paper himself and was analyzed on the bsis of item analysis. After the item analysis, very difficult and easy question was corrected and was prepared for pre-test and post-test. In the teaching period of one month, Experimental group was taught by using GeoGebra and control group was taught by using traditional method where was not used any ICT tool in the control groups. After the one month, the researcher was conducted post-test on both group using the same question of pre-test. At first, Test items was ensured by supervisor and after than it was used seven students of Jubilant secondary school defining as piloting test. The reliability and validity was measured from the obtained score of the piloting test of the items and was used for the mathematics achievement test for this research study. The data was interpreted from the obtaining score of the both groups and compared them for the final decision in this research study.

Questionnaire. The questionnaire was used to analyze student's perception towards GeoGebra software in teaching mathematics. This study contains ten items of questionnaire based on five point Likart scale. Ten items of the questionnaire are

categorized in to three fields such that GeoGebra in mathematics, GeoGebra geometry and GeoGebra in classroom. The questionnaire based on five point Likart scale has shown in the Appendix-4. The reliability and validity of the questionnaire was verified by supervisor before testing student's perception towards GeoGebra software.

Control Mechanism

Control mechanism helped to the researcher to control the environment of the research time. The researcher controlled extraneous variables through research design to increase validity of the result. In this study the researcher took equal time on the both groups and taught by himself. Same test paper was provided on both groups for pre-test and post-test. Also the researcher checked the test paper himself for the both groups. The distance of both school for experimental groups and control group was maintained. Course content was same as recommended by CDC of grade IX. Interaction effect of the students was controlled by maintain the distance between two school.

Validity and Reliability of the Tools

Validity is the most important tool to ensure the quality of the test. It increases the quality of measurement. In this study, validity of achievement test and students perception scale approved by supervisor and took ideas with subject teacher of the school and subject experts. The researcher had conducted piloting test including seven students of jubilant secondary school at grade IX to check reliability of the test. Split half method was used to determine reliability of the test. The reliability coefficient r = 0.94 was found so the mathematics achievement test was found highly reliable. The time duration of the achievement test was determined from the particular students of selected students. The SPSS tool was used to analyzed and interpret the data. The

researcher used mathematics achievement test on both group and students perception towards GeoGebra based on five point Likart scale was used on only experimental group. After the mathematics achievement test, data was compared for final decision and student's perception was analyzed for this research study.

Data Analysis and Interpretation Procedure

The data analysis is the most important part of the research study. Data analysis procedures are based on data collection tool and techniques. This study was based on quantitative research design. The researcher was defined Yamunananda Namuna secondary school as experimental group and Tribhuvan janta secondary school as control group. The time duration of teaching period was one month on both group and same topic was taught on both group. Mathematics achievement test as pre-test and post-test was conducted on both group to measure achievement of the students. The questionnaire was formulated based on five point Likart scale involving Strongly Agree, Agree, Undecided, Strongly Disagree and Disagree. It was formulated to measure the student's perception towards GeoGebra software in teaching geometry for the experimental group only. The researcher was used mean, standard deviation and t-test to analyze the collected data. Also percentile was used to measure the perception of students about GeoGebra software in teaching mathematics. The statical tool SPSS 16.0 had used to analyze and interpret of collected data from both groups.

Chapter IV

Analysis of Data and Interpretation of Results

This section is main part of the research study. This chapter deal with the analysis and interpretation of collected data. In this experimental research study where data were collected from achievement test (pre-test and post-test) and questionnaire based on five point Likart scale. This study is related to effectiveness of GeoGebra in teaching geometry at grade IX. The objective of this research study were to compare achievement of the student's between experimental and control groups and to explain student's perception towards GeoGebra in teaching geometry at grade IX. Two public school Yamunananda Namuna Secondary School for experimental groups and Tribhuvan Janata Secondary school for control groups were selected of Rukum (west) distric to complete the research work. The data was analyzed by using the SPSS 16.0.

The researcher started data collection with conducting pre-test in experimental and control groups. The experimental groups was taught by using GeoGebra and control group was taught by using traditional methods. The post-test was conducted after one month treatment on both groups and same test was used on both groups. The questionnaire was based on five point Likart scale which was used on experimental groups to measure perception of the students towards GeoGebra software. The collected data were analyzed and interpreted under the followings topics.

- Comparison of achievement scores in pre-test.
- Comparison of achievement scores in post-test.
- Student's perception towards GeoGebra software.

Comparison of Achievement Scores in Pre-test

In the achievement test, there were thirteen subjective items and that test was conducted in both groups related to the topic triangle and parallelogram at grade IX. The individual score of the students in experimental and control group in pre-test are shown in Appendix 1. The summery of calculation for experimental and control group of pre-test is shown in the following table II.

Table II: Result of independent t-test in pre-test

Groups	N	Mean	Std. Deviation	t	Significance (2-tailed)
Experimental	27	7.88	4.07	0.367	0.715
Control	29	7.55	2.57		

t-value significant at p<0.05

Above table value was calculated with the help of SPSS 16.0. This table Shows that experimental groups mean is 7.88, control group mean is 7.55 and score of mean difference between experimental and control group is 0.33. Also t-value is 0.367 at 5% significance difference, From the 2-tailed p value is 0.715 (i.e $p > 0.05$). Thus null hypothesis is accepted. This shows that there was not significance difference between mean score of the experimental groups and control groups. From this result there is no significance difference between the average achievement of students whom would be taught by GeoGebra and traditional method in pre-test. This result states that the both group results are similar and the students have similar abilities.

From the above table II shows that mean score of the both groups has same but standard deviation of experimental group has more than control group. It shows that achievement of experimental group in pre-test has less consistent than control group. It must be improved in achievement score of post-test and researcher need to consider student abilities at the period of teaching learning process.

Comparison of Achievement Scores in Post-test

Post-test was conducted after one month treatment of both groups. Experimental groups was taught by using GeoGebra and control group taught by traditional method. Also both groups was taught same topic in the treatment time. On the both groups, same items was used on the post-test which was used on the pre-test on both groups. A set of individual score of students on post-test is presented in appendix 2. The summery of independent t-test is shown in the following table III.

Table III: Result of independent t-test in post-test

Groups	N	Mean	Std. Deviation	t	Significance (2-tailed)
Experimental	27	22.33	2.81	4.963	0.000
Control	29	17.48	4.38		

t-value significant at p<0.05

This table shows that experimental groups mean is 22.33, control group mean is 17.48 and score of mean difference between experimental and control group is 4.58. Also t-value is 4.963 at level of 5% significance difference. From the 2-tailed p value is 0.000 which is less than 0.05. Thus null hypothesis is accepted. This shows that there was significance difference between mean score of the experimental groups and

control groups. From this result there was significance difference between the average achievement of students whom would be taught by GeoGebra and traditional method in post-test. This result shows that achievement of the students taught by using GeoGebra is better than taught by traditional method. From this, achievement of experimental group is higher than control group in this research study.

From the above table III shows that mean score of experimental group has more than control group. This shows that GeoGebra based teaching is effective at secondary level. Also, standard deviation of experimental group has less than control group. It shows that achievement of experimental group in post-test has more consistent than control group.

Student's Perception Towards GeoGebra

The student's perception towards GeoGebra software was determined using a set of questionnaire based on five point Likert scale. A set of questionnaire was distributed to experimental group consisting ten items based on different dimension. The set of questionnaire was distributed twenty six students of experimental group. In the all items, students were used tic marks at appropriate places of the all items and after fifteen minute it was returned. There were included positive and negative statement in the set of questionnaire. There were included five options for students views towards GeoGebra software which are Strongly agree, Agree, Undecided, Disagree and Strongly disagree. These are reduced to Agree, Undecided and Disagree. Also from these Agree (Strongly Agree and Agree), Disagree (Strongly Disagree and Disagree). The ten items of the questionnaire were categorized in to three section as GeoGebra in Geometry, GeoGebra in mathematics and GeoGebra in classroom which are described below.

GeoGebra in geometry. Geometry is the branch of mathematics which is connected shape, size, and position of figures. GeoGebra software visualizes geometrical figure and gives clear concept to understand different problems.

Table IV: Students Perception towards GeoGebra in teaching geometry**.**

S.N	Items	Agree (%)	Undecided (%)	Disagree (%)
1	GeoGebra software visualizes Geometrical theorem with figure.	84.6	15.4	0
2	GeoGebra software helps students to improve geometrical knowledge.	73.1	19.2	7.7
3	I like GeoGebra software to use in teaching geometry in the classroom.	88.5	7.7	3.8

Source: Field study

From the above table students has the positive perception towards GeoGebra software in teaching geometry at grade IX. From the above table IV, 84.6 % agreed GeoGebra software visualizes geometrical theorem with figures and 73.1 % mentioned GeoGebra software helps students to improve geometrical knowledge. About 88.5 % students mentioned they liked GeoGebra software to use in teaching mathematics class.

From the above data, Students that agreed GeoGebra is effective tool in teaching mathematics to visualize the 2D and 3D shapes. Student were more interested in the classroom and they ask question which they have confusion in the teaching lesson. When I started to use GeoGebra software in the classroom, they

focused towards on the projector screen to visualizing content. Student were felling happy to study in the learning process.

   GeoGera in mathematics. GeoGebra is the most important ICT tool for the students to develop higher order thinking in mathematics education. Mathematics education is the base for scientific development. The traditional teaching method has developed based on ICT tool. The popularity of GeoGebra software is increasing at school level to university level. GeoGebra software makes learning mathematics most meaningful and visualizes related concepts.

Table V: Students perception towards GeoGebra in teaching mathematics**.**

S.N	Items	Agree (%)	Undecided (%)	Disagree (%)
1	GeoGebra software helps to increase mathematics achievement.	80.8	7.7	11.5
2	Mathematics classroom becomes more interesting If teacher uses GeoGebra software.	80.8	11.5	7.7
3	GeoGera based teaching helps students to remember for long time about geometrical theorem and problem than traditional method.	88.5	7.7	3.8

Source: Field study

   Result from above table shows that, About 80.8 % mentioned GeoGebra software helps to increase mathematics achievement and also 80.8 % students are agreed to mathematics classroom becomes more interesting if teacher use GeoGebra software. Also about 88.5 % students mentioned GeoGebra based teaching helps

students to remember for long time about geometrical theorem and problem than taught by using traditional method.

I found in the teaching period that students were interested towards GeoGebra software. Also, they were creative and seems confidence in the teaching content because they gave as much as quick answer of teacher's questions. If they have any confusion in any question, they ask each to other friend and would not get result ask me. From these different views, GeoGebra is supporting tool for the learner in teaching mathematics at school level.It motivates the students in the classroom and helps to students to increase mathematics achievement.

GeoGebra in mathematics classroom. The teaching pedagogy has been changed which depends on ICT tool. To success in educational objective of curriculum, Classroom teaching must be effective. Geogebra is most effective tool in classroom teaching for teacher and learner. It visualizes and manipulates the shapes in 2D and 3D. Also students are more interested to learn by ICT based classes than traditional method. In the mathematics classroom, Students were motivated and they seems to more active when teacher use Geogebra software in mathematics classroom.

Table VI: Students perception towards GeoGebra in mathematics classroom**.**

S.N	Items	Agree (%)	Undecided (%)	Disagree (%)
1	GeoGebra software creates interesting environment in the classroom.	92.3	7.7	0
2	GeoGebra software motivates students and easily helps to understand geometrical concepts.	73.1	15.4	11.5
3	GeoGebra software does not encourage students to participate in classroom activity.	3.8	15.4	80.8
4	Students feel boring to learn by using GeoGebra software.	0	7.7	92.3

Source: Field study

From the above table VI, About 92.3 % students mentioned GeoGebra software creates interesting environment in the classroom and 73.1 % students agreed GeoGebra software motivates students and easily helps to understand geometrical concepts. Also about 80.8 % students are disagreed them GeoGebra software does not encourage students to participate in classroom activity and 92.3 % students disagreed them about students feel boring to learn by using GeoGebra software.

From the above data, I found that GeoGebra based clas were more effective than traditional method. Student were agreed GeoGebra is useful tool in teaching mathematics and they indicated it gives exact information in 2D and 3D shapes in teaching mathematics. They indicated that it gives brief information on mathematics content in the classroom. Thus, GeoGebra software encourage students and helps them to make connection with visual representation in the classroom.

In summary, According to the result of pre-test and post-test and data of the students perception, GeoGebra based teaching is more useful in teaching mathematics at secondary level. Also, according to the class observation note students were more active and participated regularly in the experimental group. According to the student's view, use of GeoGebra new area of study in teaching mathematics at secondary level. It visualizes the 2D and 3D mathematical concepts and gives clear concepts. Students in experimental group outperformed their peer than the control group, So GeoGebra is an effective tool in teaching mathematics at secondary level.

Chapter V

Findings, Conclusion and Implication.

This chapter gives the summery of the study, finding, conclusion, recommendation for educational implication and recommendation for further study.

Finding of the Study

This part of the study interprets the result of research question with answer. This is an experimental research based on the topic " Effectiveness of GeoGebra in teaching geometry at grade IX ". To analyze and interpret the effectiveness of GeoGebra, two objective were conducted; to compare achievement of the students in teaching geometry taught by using GeoGebra and without GeoGebra and to explain student's perception towards GeoGebra software.

This study was based on quantitative research design where researcher had selected quasi experimental design as pre-test and post-test non-equivalent design. To analyze the objective of this research study on effectiveness of GeoGebra software, The researcher was selected two government school YNN secondary School for experimental groups and TJ Secondary School for the control groups. The researcher was used mathematics achievement test to collect the data of this research study. At first, pre-test was conducted on both groups and found the same achievement score on the both groups. Post-test was conducted after one month teaching on E.G with using GeoGebra software and by traditional method on C.G. Same achievement test was used on both groups with same items. The statistical tool SPSS was used to analyze and interpret of pre-test and post-test data. Questionnaire was used to measure the students attitudes towards GeoGebra software based on five point Likart scale.

Validity and reliability was ensured by supervisor and subject teacher where split-half method was used to ensure the validity of the tool.

The external and internal variable were controlled by the researcher to increase validity and reliability of this research study. The subject teacher had helped to manage the class environment in the research time. From the analysis of collected data, GeoGebra based teaching is more effective than traditional method and students gave positive suggestion to use GeoGebra software in teaching mathematics at secondary level. Also result of questionnaire based on five point Likart scale shows, most of the students were agreed about the use of GeoGebra software in mathematics classroom. After the analysis of data, main finding are listed below.

- The mean achievement score of experimental group and control group was 7.88 and 7.55 respectively. This shows that, there was not significance difference between achievement of the students on experimental groups and control groups in pre-test.

- The students of experimental group were more active and participation of the students was higher than the control group by the comparing of students attendance and analyzing class observation note. Thus, GeoGebra based teaching was more effective than by traditional methods.

- The result of post-test showed that mean achievement score of experimental group and control group was found 22.33 and 17.48 respectively. This implies that, Achievement of the students in experimental groups has better than the control groups in post-test.

- Students gave positive feedback to use GeoGebra software in teaching geometry.

- From the result of field study, 84.6% students were found GeoGebra software visualized the geometrical shapes and helps to understand easily in teaching geometry.

- GeoGebra based teaching makes more active to the students and helps to increase achievement of the students in mathematics subject.

Conclusion

Use of ICT tool helps students to learn more effectively in the classroom. Among them GeoGebra is a most important tool which is used in teaching mathematics from school level to university level. From the result of this study, GeoGebra software is useful in teaching mathematics at secondary level which gives clear concept to the students with visualizing 2D and 3D shapes. The result of post-test in this study indicates that achievement score of experimental group is better than the control group. Thus, GeoGebra software has important role in teaching geometry at school level. It helps students to visualize mathematical concept and increases the student's creativity in learning geometry at secondary level. Also comparing the result of post-test in both groups, the researcher found GeoGebra as a supporting tool for the mathematics curriculum.

The result of the post-test shows that there is significance difference in score of the both groups where experimental groups gained higher achievement than control groups, Thus GeoGebra is effective tool at secondary level. Furthermore, Students were more motivated in the classroom when teacher uses GeoGebra. Hence GeoGebra is effective tool to increase student's achievement and understanding skills. Also, From the other research based on GeoGebra software indicates that it is effective tool at secondary level. It helps student's to make connection with visual representation in

learning geometry and encourages them to solve mathematical problems related to course content. Thus, GeoGebra software is effective tool in teaching geometry at secondary level.

Recommendation for Educational Implication

GeoGebra software is considered as effective ICT tool in teaching and learning mathematics. It visualizes the different shapes and giveses clear concepts with visualizing figures. Especially, It is more useful in geometry and mensuration shapes. On the basis of the finding, some of the recommendation for the educational implication are mentioned below.

- GeoGebra software is useful to avoid weakness of traditional method and increases access of ICT based teaching environment in the mathematics classroom.

- ICT based teaching increases student achievement and seems effective in the classroom. The mathematics teacher who taught at secondary level should have trained on GeoGebra software.

- The policy maker on education must emphasis to include GeoGebra software in teaching mathematics for the increase of mathematics achievement.

- The use of GeoGebra software has been shown to be useful in improving the performance of students in learning mathematics. So mathematics curriculum should include application of GeoGebra software in secondary level.

Recommendation for Further Study

Due to the lack of time, This study was conducted in only one month. Taking small sample, This study was focused to compare achievement of the students in both groups and explain perception of the student's towards GeoGebra software on experimental groups. After this research study, Some of the recommendation for the further study are mentioned below.

- It is recommended that for the further researcher research about use of GeoGebra software in different field of mathematics.

- It is recommended that further study should be standing on cause of student impression about GeoGebra software.

- It is recommended that for the further researcher GeoGebra software is seem to improve student's performance in mathematics at school level.

- It is recommended that further study needed to examine attitude of mathematics teacher about GeoGebra software.

- It is recommended that for the further study needed to is there appropriate environment for all teacher to use GeoGebra software in teaching mathematics at school level ?

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Appendix-1

Pre-test result of the experimental and the control group

S.N	Experimental Groups	Control group
1	13	10
2	6	9
3	10	8
4	12	8
5	7	3
6	14	2
7	10	12
8	2	6
9	1	12
10	6	5
11	9	8
12	5	9
13	10	10
14	7	8
15	7	3
16	3	6
17	5	8
18	9	5
19	1	5
20	5	10
21	7	5
22	11	8
23	17	7
24	8	9
25	13	5
26	5	3
27	18	2
28		6
29		7

Appendix-2

Post-test result of the experimental and the control group

S.N	Experimental Groups	Control group
1	26	25
2	17	22
3	23	20
4	25	16
5	28	18
6	29	14
7	21	19
8	21	21
9	23	19
10	23	15
11	22	18
12	21	24
13	21	22
14	18	19
15	23	17
16	19	14
17	20	21
18	21	10
19	22	10
20	23	24
21	19	10
22	21	18
23	24	17
24	22	19
25	21	21
26	24	10
27	26	11
28		16
29		17

Appendix-3

Pre-test and Post-test Question Set

Group-A   4 × 1=4

1. दिईएको चित्रमा x को मान पता लगाउनुहोस ।
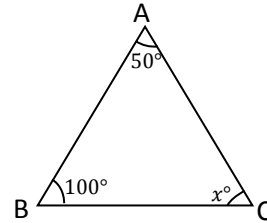
   Find the value of x from the given figure.

2. दिईएको चित्रमा **x** को मान पत्ता लगाउनु होस ।
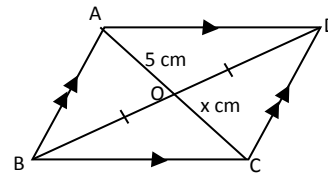
   Find the value of x in the given figure.

3. दिईएको ΔABC मा सबैभन्दा लामो भुजाको नाम लेख्नुहोस ।
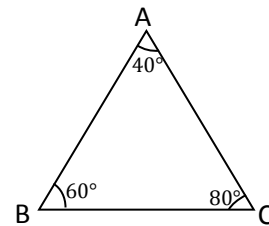
   Write the name of longest side from the given ΔABC.

4. दिईएको चित्रमा x को मान पत्ता लगाउनु होस ।
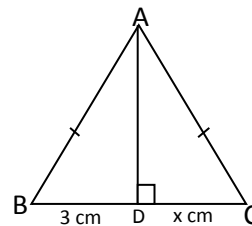
   Find the value of x in the given figure.

Group-B   5 × 2=10

5. . दिईएको चित्रमा x र y को मान पत्ता लगाउनु होस ।

   Find the value of x and y in the given figure.
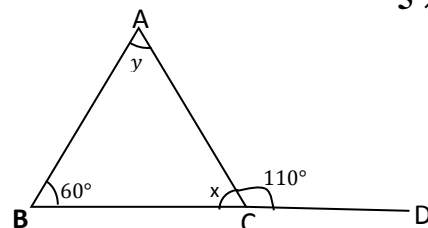
6. दिइएको चित्रमा ABCD एउटा समानान्तर चतुर्भुज हो । यदि ∡ABC = 70° भय ∡BCD र ∡ADC को

   मान निकाल्नुहोस ।
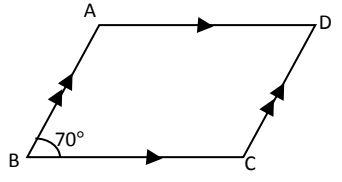
   In the given figure ABCD is a parallelogram. If ∡ABC = 70° then

   find the measure of ∡BCD and ∡ADC.

7. दिइएको चित्रमा x र y को मान पत्ता लगाउनु होस ।
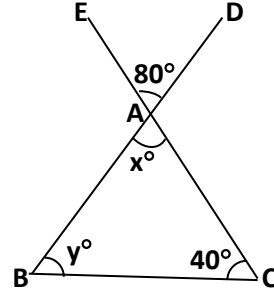
   Find the value of x and y in the given figure.

8. दिइएको चित्रमा x र y को मान पत्ता लगाउनु होस ।
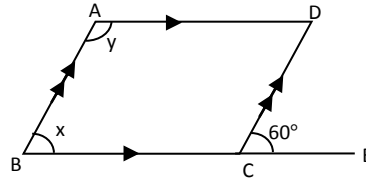
   Find the value of x and y in the given figure.

9. दिइएको चित्रमा x को मान पत्ता लगाउनु होस ।
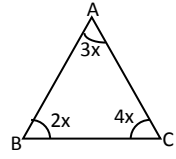
   Find the value of x in the given figure.

Group-C   **4× 4 = 16**

10. त्रिभुजको एक भुजालाई वढाउँदा बन्ने बाहिरी कोण दूई अनासन्न भित्रि कोणहरुको योगफलसंग बराबर हुन्छ भनि

    प्रमाणित गर्नुहोस ।

    Prove that the exterior angle of a triangle is equal to the sum of the opposite interior

    angle.

11. समानान्तर चर्तुरभुजका विकर्णहरु आपसमा समद्विभाजन हुन्छन भनि प्रमाणित गर्नुहोस ।

    Prove that the diagonals of parallelograms bisect each other.

12. दिइएको चित्रमा AB = AC र PQ//BC भय AP = AQ हुन्छ भनि प्रमाणित गर्नुहोस ।
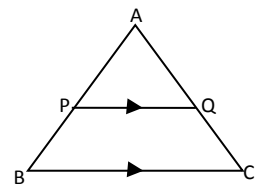
    In the figure, AB = AC and PQ//BC. Prove that AP = AQ.

13. समानान्तर चर्तुरभुजका सम्मुख भुजाहरु र सम्मुख कोणहरु बराबर हुन्छन भनि प्रमाणित गर्नुहोस ।

Prove that the opposite sides and opposite angles of parallelogram are equal.

Best Of Luck

Appendix-4

Student's Perception Towards GeoGebra Software

Name: …………………………….   Roll No: …….

Class: 9   Subject: Comp. Mathematics

School: …………………………………………………..

S.N	Items	Strongly agree	Agree	Undecided	Disagree	Strongly Disagree
1	GeoGebra software creates interesting environment in the classroom.					
2	I like GeoGebra software to use in teaching geometry in the classroom.					
3	GeoGebra software helps to increase mathematics achievement.					
4	GeoGebra software helps students to improve geometrical knowledge.					
5	GeoGebra software visualizes Geometrical theorem with figure.					
6	Mathematics classroom becomes more interesting If teacher uses GeoGebra software.					
7	GeoGera based teaching helps students to remember for long time about geometrical theorem and problem than traditional method.					
8	GeoGebra software motivates students and easily helps to understand geometrical concepts.					
9	GeoGebra software does not encourage students to participate in classroom activity.					
10	Students feel boring to learn by using GeoGebra software.					

Appendix-5

Item analysis of the test

Students \ Items	Upper 27% students			Middle 46% students				Lower 27% students			P %	D value	Remarks
	1	2	Total	3	4	5	Total	6	7	Total			
1	1	1		1	1	1		1	1		100.00	0	Rejected
2	1	1		0	1	1		1	0		71.43	0.5	Accepted
3	1	1		1	1	1		1	1		100.00	0	
4	1	1		1	1	1		1	1		100.00	0	
5	1	1		1	1	1		1	1		100.00	0	
	1	1		1	1	1		1	1		100.00	0	
											100.00	**0**	Rejected
6	1	1		0	1	1		0	0		57.14	1	
	1	1		0	1	1		0	0		57.14	1	
											57.14	**1**	Accepted
7	1	1		0	1	1		1	1		85.71	0	
	1	1		0	1	1		1	1		85.71	0	
											85.71	**0**	Accepted
8	1	1		1	1	1		0	0		71.43	1	
	1	1		1	1	0		0	0		57.14	1	
											64.28	**1**	Accepted
9	1	1		1	1	1		0	0		71.43	1	
	1	1		1	1	1		0	0		71.43	1	
											71.43	**1**	Accepted
10	1	1		1	1	1		1	1		100.00	0	
	1	1		1	1	1		1	1		100.00	0	
	1	1		1	1	1		1	1		100.00	0	
	1	1		1	0	1		0	1		71.43	0.5	
											92.85	**0.13**	Rejected
11	1	1		1	1	1		0	1		85.71	0.5	
	1	1		1	1	1		0	1		85.71	0.5	
	1	1		1	1	1		0	1		85.71	0.5	
	1	1		1	0	1		0	1		71.43	0.5	
											82.14	**0.5**	Accepted
12	1	0		0	1	1		1	1		71.43	-0.5	
	0	0		0	0	0		0	0		0.00	0	
	0	0		0	0	0		0	0		0.00	0	
	0	0		0	0	0		0	0		0.00	0	
											17.85	**-0.13**	Rejected
13	1	1		1	1	1		1	0		85.71	0.5	
	1	1		1	1	1		1	0		85.71	0.5	
	1	1		1	1	1		1	0		85.71	0.5	
	1	1		1	0	0		1	0		57.14	0.5	
											78.57	**0.5**	Accepted

Interperation criteria for D.
-1-0.19   Neligile
0.20-0.29   General
0.30-0.39   Good
0.40-1.00   Verygood
Source: Ebel & Frisbile, 1991

Teaching episoid-1

Time: 45min

1. Specific Objectives:

At the end of the class the students will be able to

i) prove that sum of the inner angle of triangle is two right angle.

ii) find the value of unknown angles related to the theorem sum of inner angle
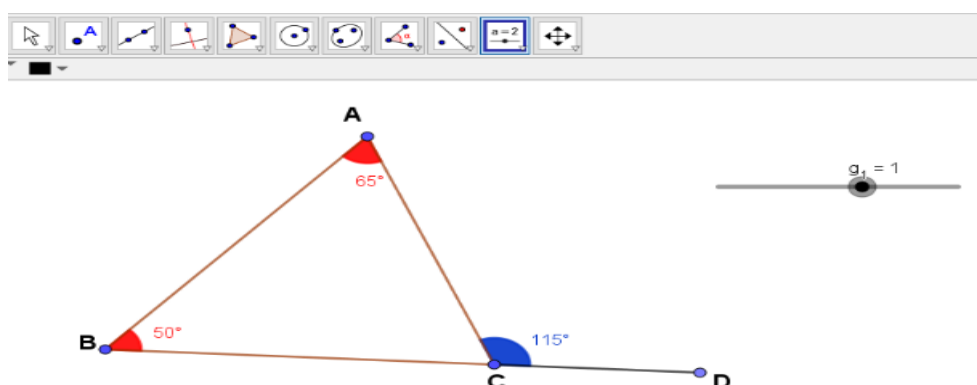
of triangle.

2. Instructional materials:

Laptop, GeoGebra software, projector screen

3. Teaching learning activities:

Activity-1: Firstly, I starts the class by revising previous class about types of

triangle by sides and angles.

Activity-2: Show the statements of the theorem "the sum of three inner angles

of triangle is equal to two right angles." and discuss with students.

Activity-3: Use the Geogebra software and visualizes the figures with related
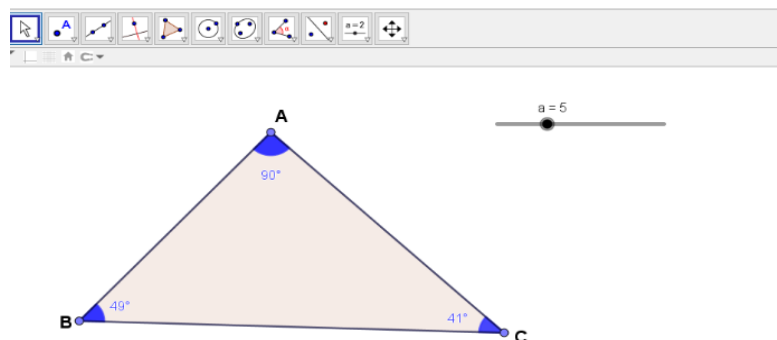
theorems.

Activity-4: Show the ways of solving theorem using GeoGebra software with statements and reasons and clarify to the students.

Activity-5: Write the following questions and provide idea to solve that questions.

Find the value of x in the given figure.
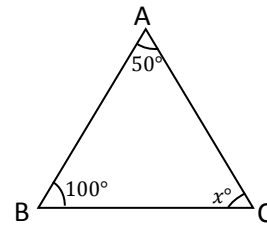
4. Evaluation:

Ask question to the students related to sum of inner angles of triangle ?

5. Assignment:

Exercise 12.1   Q.No. 1 (a) and (b).

Teaching episoid-2

Time: 45min

1. Specific Objectives:

At the end of the class the students will be able to

i) prove the theorem the exterior angle of triangle is equal to the sum of non-adjacent interior angle.

ii) find the value of unknown angles related to exterior angle theorem.

i.e.objective (i)

2. Instructional materials:

Laptop, GeoGebra software, projector screen

3. Teaching learning activities:

Activity-1: Firstly, I starts the class by revising previous class about sum of three inner angle of triangle is two right angle.

Activity-2: Use the Geogebra software and show the figures with related theorems.

Activit-3: Show the statements of the theorem " the exterior angle of triangle is equal to the sum of non-adjacent interior angle." and discuss with students.

Activity-4: Clearify to the students about way of solving theorem using GeoGebra software with statements and reasons.

Activity-5: Write the following questions and provide idea to solve the questions.

Find value of x in the given figure.
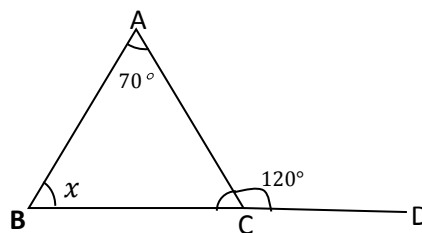
4. Evaluation:

What is the relation between exterior angle of triangle and sum of non-adjacent interior angle ?

5. Assignment: Exercise 12.1   Q.No. 1 (b) and (c).

Teaching episoid-3

Time: 45min

1. Specific Objectives:

At the end of the class the students will be able to

i) prove that the base angle of isosceles triangle are equal.

ii) Solve the theorem related to the theorem base angle of isosceles triangle are equal.   i.e. objective (i)

2. Instructional materials:

Laptop, GeoGebra software, projector screen

3. Teaching learning activities:

Activity-1: Firstly, I starts the class by revising previous class about exterior angle theorem of triangle

Activity-2: Show the statements of the theorem on projector screen and clearify to the students.

Activity-3: visualize the figure of related theorem by using geoGebra software.
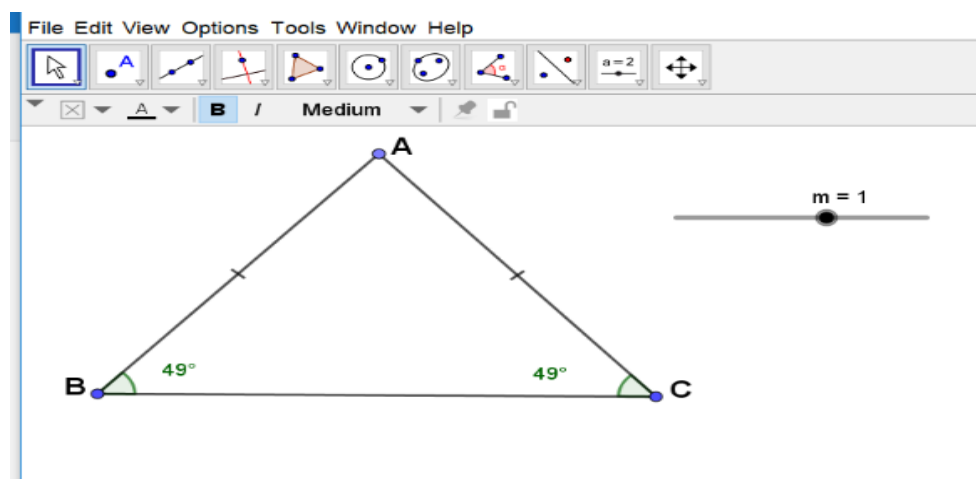
Activity-4: Provide idea to the students about ways of solving theorem using GeoGebra software with statement and reasons where base angles of isosceles triangle are equal

Activity-5: Write the following questions and provide idea ways of solving.

Find the value of x in the given figure.
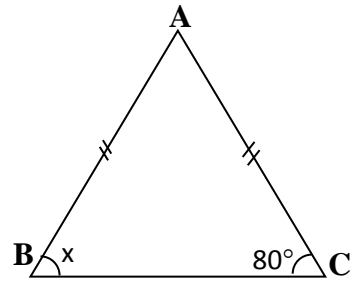
4. Evaluation:

Find the value of x and y in the given figure.
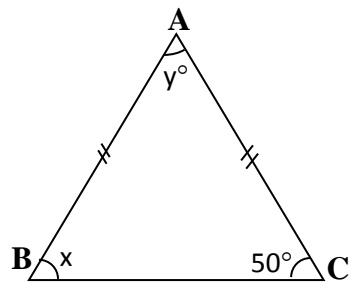
5. Assignment: Exercise 12.1 Q.No. 1 (a) and (b).

Teaching episoid-4

Time: 45min

1. Specific Objectives:

At the end of the class the students will be able to

i) prove theoretically opposite side and opposide angle of parallelogram are

equal.

ii) find the unknown angles and sides of parallelogram.

2. Instructional materials:

Laptop, GeoGebra software, projector screen

3. Teaching learning activities:

Activity-1: Show the figure of parallelogram by using GeoGebra software and

clearify to the students it's non adjacent opposite side and opposite angles of
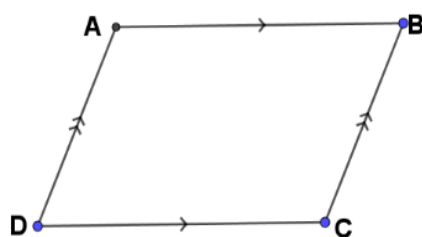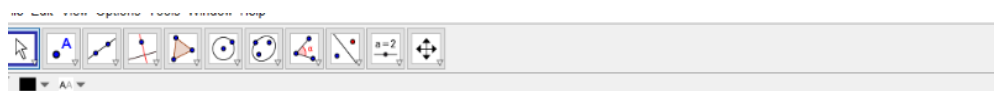
parallelogram.

Activity-2: Draw the diagonal of parallelogram by using GeoGebra software and clearify to the students about it.
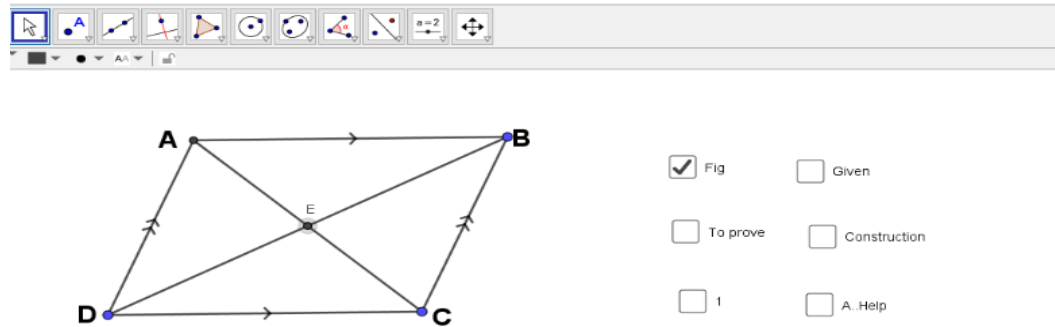

Activity-3: Show the figure of parallelogram with it's opposite sides and opposite angles and visualize on the GeoGebra software in the projector screen.

Activity-4:Provide idea to the students to prove theoretically with using Geogebra software.

Activity-5: Guide to the students about way of solving the following question.

Find the value of x and y in the given figure.
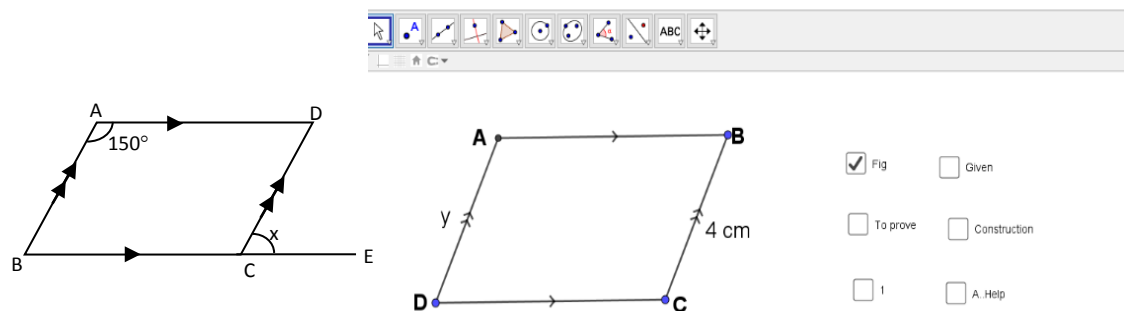
4. Evaluation:

Prove that opposite angle and opposite side of parallelogram are equal.

5. Assignment: Exercise 13.1   Q.No. 2 (a) and (b).

Teaching episoid-5

Time: 45min

1. Specific Objectives:

At the end of the class the students will be able to

i) Prove that diagonal of parallelogram bisect each other.

ii) find the unknown size related to bisected angle of parallelogram.

2. Instructional materials:

Laptop, GeoGebra software, projector screen

3. Teaching learning activities:

Activity-1: At first, I will revise the previous class about opposite side and opposite angle of parallelogram.

Activity-2: Show the statements of the theorem on projector screen and explain about it.

Activity-3: Show the figure of parallelogram with bisected diagonal and visualize with the help of GeoGebra software and discuss with students.
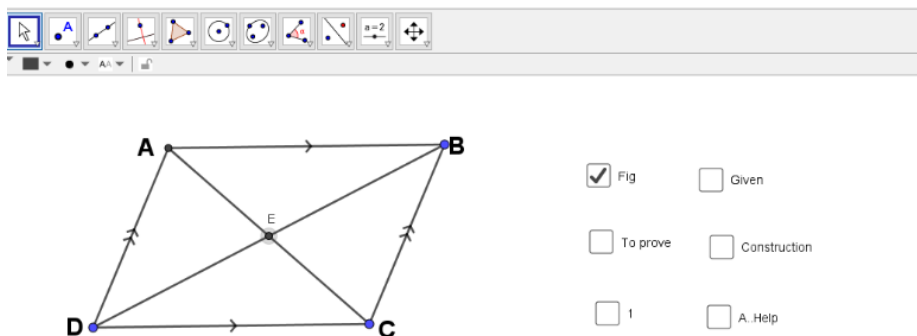
Activity-4: Show with the help of GeoGebra software and guide students to prove theoretically that diagonal of parallelogram bisect to each other.
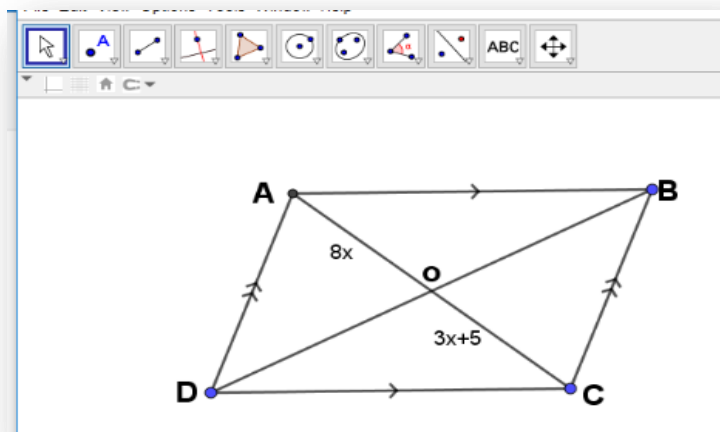
Activity-5: Provide idea toe students about ways of solving the following question to the students.

Find the value of x in the given figure.
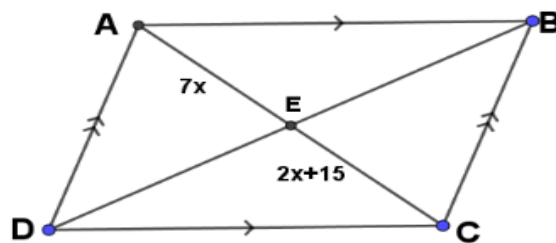
4. Evaluation:

Find the value of x in the given figure.

5. Assignment: Exercise 13.1   Q.No. 1 (e) and (f).