Chapter- I

INTRODUCTION

Background of the Study

Mathematics is a subject which affects all aspects of human life at different levels. Mathematics is foundation of scientific, technological knowledge that is vital in the development of a nation. It is realization of the vast application of mathematics, that mathematics made to post that a disciplined and ordered pattern of life can only be achieved through the culture of mathematics (Eraikhuenmen 2003). Mathematics is fundamental to the study of physical science and engineering of all kinds. It is applied in medicine, biological, science, geometry, economics, business and management studies.

Advance Learner Oxford Dictionary, (1995) states that ‘Mathematics is the science of number and space'. According to famous mathematician John luck 'Mathematics is a way to settle in the mind a habit reasoning'. Mathematics is a way of thinking i.e. a way of organizing, analyzing and synthesizing of data. At primary level, mathematics teaches us four basic operations i.e. addition, subtraction, multiplication and division. At secondary level, mathematics is more than numbers with operations. At university level, it is very difficult to define mathematics under the few operations due to its vague subject matter.

The history of mathematics tells us that all civilizations have always been striven towards development of mathematics, whatever its sources, mathematics has come down to present by two main stems of numbers and forms. Mathematics is essential understanding every discipline. Mathematics plays a vital role in developing human resources.

The term mathematics may be defined in number of ways. It is an exact science which is related to measurement and calculation. According to New English Dictionary (1702), Mathematics in a strict sense is the abstract science which investigates deductively

the conclusion implicit in the elementary conception of spatial and numerical relationship". "Mathematics is way to settle in mind a habit of reasoning" (John Lock). "Mathematics is the logical study of space arrangement, quantity and other many related concepts" (James and James, 1986). "Mathematics is a way of thinking a way of organizing, analyzing and synthesizing a body of data" (Howson, 1973).

The term 'Achievement' means the knowledge of students in a particular subject. Mathematics achievement of students indicate amount of knowledge, skills understanding in the mathematics subject matter. It is the process or fact of gaining something. Achievement is always needed in all field, however it has been taken center place in education, particularly evaluation process.

In the context of Nepal, various factors have been adduced in mathematical achievement. The achievements in mathematics related to different factors such as

Volume of work completed, task orientation and skill acquisition, self-concept feeling of inadequacy, motivate and self-confidence, shortage of qualified mathematics teachers, poor facilities of equipment's and instructional materials for effective teaching and the use of traditional chalk and talk methods. Moreover individual characteristics such as intelligence, combinative styles, and personality play an important role in learning and instruction also have significant impact on achievement. The finding have shown that individual student's characteristics such as motivational orientations, self-esteem and learning approaches are other important factors influencing academic achievements.

Mathematics achievement test is not possible to measure intelligence and efficiency of a student directly. So, we use the indirect measurement. We use test score usually designates knowledge and skill developed during school education. Therefore, the marks obtained by students are considered as the academic achievement (Good, 1959).

Achievement has been regarded as a very important indicator to judge the quality of education. Students always expect to gain higher achievement. The achievement of the students is a powerful entrance for any job and other opportunities.

This study intends to find out whether the use local low cost instructional materials increase student's score.

According to the dictionary of education, instructional materials means any device with certain contain or function that is used for teaching process, including books, textbooks, supplementary reading materials, audio visual and other sensory materials scripts for radio and television, instructional programmed for computer managed instruction or manipulation (Good, 1959). This definition reveals that those materials which help in instructional process either they are audio or visual are the instructional materials.

Instructional materials are as an essential for mathematical teachers as the spices are essential for the chef. They are necessarily extra ingredients that make teaching and learning mathematics pleasant satisfying experience. Burton (1963) as cited in Agrawal (1997) says ‘Instructional materials are those sensory objects or image which initiate or stimulate and reinforce learning'. The same type of definition was forwarded by Good, (1959). He believes that instructional materials are those aids which help in completing triangular process of learning i.e. motivation, classification and stimulation. Edgerdele (1964) as cited in Agrawal (1997) has a bit different view of instructional materials. He says that “instructional materials are those devices by the use of which communication of ideas between persons and groups in various teaching situation in helped”.

According to the Dienes (1978), the use of concrete materials in the classroom is to build up mathematical imagery. Such imagery once build up can be manipulated without

the aid of any concrete objects.' Instructional materials help students classify, establish, correlate and co-ordinate accurate concepts, interpretations and appreciations and enable them to make learning more concrete, effective, interesting, inspirational meaningful and vivid. They help in completing the triangular process learning viz, motivation, stimulation and classification. The aim of teaching with instructional materials is clearing the channel between the learner and the things that are worth learning. The basic assumption underlying in using instructional materials is learning, clear understanding and concept building through sense experience.

Moreover, instructional materials provide significant gains in informational learning, retention and recall, thinking and reasoning activity interest, imagination and better assimilation. The instructional materials are the stimuli for learning 'why', 'how', 'when' and 'where'. Therefore, instructional materials are widely used all over the world in learning and teaching activities.

Statement of the Problem

The role of mathematics in the understanding of the foundations and structure of science, technological advancement, and economic development as well as in the understanding of inter-relationship between disciplines is a very significant one. Also, mathematical methods have strongly penetrated many fields of knowledge and human endeavor. Mathematics is a compulsory subject in all primary and secondary schools in Nepal. As important as this subject is, students are failing at an alarming rate. The failing rate is further high as the locations of schools are rural and remote. Students are expected to have mastery on any aspect of mathematics to enhance some development in science and technology. However, students are biased that mathematics is a difficult subject to understand and this is transferred to the classroom teaching, consequently, subjects where

an aspect or element of mathematics is not perfectly learnt. Other subjects which theoretical bases are interpreted on mathematical concepts such as physics, chemistry, geography and economics are not perfectly learnt. It has been observed that teaching and learning difficulties in mathematics may be traced to abstract nature of the subject, language problem, students' attitude towards the subject, student inability to visualize correctly, lack of mathematical models, teachers' attitude towards the concepts and lack of qualified teachers.

In recent years, attention was focused on the use and role of instructional materials in mathematics to improve students' academic performance. This implies that the teaching of mathematics without the use of instructional materials may certainly result in poor academic performance. Students get motivated when they are actively involved in the teaching learning process and this will minimize teaching of mathematics in abstraction. Use of instructional materials in teaching and learning makes students to learn more and retain better what they have been taught and that it also promotes and sustains students' interest. It also allows the learners to discover themselves and their abilities. Students learn more when they see what they are being taught. There has been much concern expressed about the apparent fall in the standard of education at the basic level. The problem is that students are failing in mathematics at an alarming rate despite its importance. It is worth knowing that failure in this subject may hinder a student from being promoted to the next class or from gaining admission into a higher institution of learning for further studies. Further, it increases dropout and class repetition rates. The problem is more severe in the remote area a schools like in Darchula district.

Therefore, it needs to increase achievements and motivation of the mathematics students. Thus, the key problem statement in question form is: Do the use of instructional

materials increase achievements and motivation of the basic level, grade eight students? In this background, following research questions are answered.

- Do the achievements scores of students in mathematics increase with the use of instructional materials?
- Do the instructional materials motivate students toward mathematics learning?

Objectives of the Study

The general objective of the study was to find the effectiveness of instructional materials in the mathematics classrooms at grade eight. The specific objectives of the study had the following objectives:

- To compare the achievement of students taught by using instructional materials and without using instructional materials.
- To compare the students' motivation towards mathematics learning with and without using instructional materials.

Hypotheses of the Study

Considering the objectives of the study, the following hypotheses have been tested:

1 H_0**:** There is no significant difference between the average achievement of grade eight students in mathematics who were taught with and without use of the instructional materials (i.e.$\mu_{1=}\mu_2$).

H_1**:** There is significant difference between the average achievement of grade eight students in mathematics who were taught with and without use of the instructional materials (i.e. $\mu_1 \neq \mu_2$) where μ_1 and μ_2 are the average achievements of mathematics students of grade eight of experimental and control group respectively.

2 H_0: Students taught with and without instructional materials are equally motivated towards mathematics.

H_1: Students taught by using instructional materials are not equally motivated towards mathematics than without using instructional such materials.

Significance of the Study

Modern methods of teaching need the use of concrete instructional materials. Use of such materials improves teaching learning activities. Further, it increases student's scores with an improvement in the concentration of motivation of the learners. The role of such materials is more essential in mathematics classes because on the one hand mathematics concepts are difficult to understand, on the other hand students feel bore in the mathematics classroom having very little motivation toward the subject matter that the students have to learn. The use of instructional materials is more essential in remote area schools where the subject matters are discussed just using daily classroom materials such as chalk, blackboard/whiteboard, ruler, protector etc. This study will examine the impact of additional instructional materials in grade eight classroom at remote school of Darchula district to find out either use of instructional materials improve the scores of students as well as their motivation in mathematics classroom. It is hoped that the results will be helpful for teachers, trainers as well as policy maker to improve mathematics learning activities by using instructional materials in the classroom. Therefore, research outcomes of this study will be beneficial to students, parents and teachers in upgrading mathematics scores at basic level, particularly remote districts like Darchula.

Delimitations of the Study

The following were the delimitation of this study:

- The study was based on only one public school of Darchula district.

- This study was based on the mathematics class of grade eight of Shree Galainath Secondary School, Jharkanda, Darchula.
- The study had covered only the content of Geometry of grade eight.
- This study was based on experimental design.

Definitions of the Key Terms

Instructional Materials: Instructional materials are the tools used by teacher in the teaching learning situation to motivate students as well as to concretize mathematical concept.

Innovative Instructional Materials: The lists of all those materials, which are used in teaching learning process, are called instructional materials and which are made by wood and just like different bases of triangles which are made by wood and geometric box.

Traditional Instructional Materials: The list of all those materials, which are used in teaching learning process, are called instructional materials and which are chalk, board and duster.

Achievement: It is concerned only with scores on the test which is specially designed to measure the effect of intervention.

Effectiveness: The effectiveness in this study was defined in terms of the magnitude of the score obtained by experimental and control group in the mathematics achievement test.

Public School: Public school in this study refers to those schools which are completely financially supported by government.

Experimental and Control Group: In this study experimental group was that group, in which researcher taught by using instructional materials. On the other hand control group was that group, in which researcher taught by without use instructional materials.

Chapter - II

REVIEW OF THE RELATED LITERATURE

A critical review of the literature helps the researchers to develop the thought, understanding and insight into previous research works that relates to the present study. A review provides the knowledge of what has been established known or studied and what has been attempted to get. It is more important to draw a meaningful conclusion particularly comparative research where the result in the similar context can be compared with earlier research. The purpose of literature review is to find out the gap in research for further study, and to develop conceptual and theoretical framework and to contribute existing knowledge. For this, the researcher reviewed the literature by organizing empirical and theoretical review.

Empirical Review

Though there are some studies held related in the field of teaching being based on the effectiveness of instructional materials but none of the researches are carried out to find out the effectiveness of using instructional materials in teaching mathematics. Some research studies are nearer to the present topic which is discussed as below.

Chaudhary, (2011) had conducted a study on effectiveness of instructional materials on teaching menstruation at secondary level. The main concern of the study was to compare the achievement of students taught by using instructional materials and without instructional materials and to find out the effectiveness of instructional materials on teaching menstruation. Experimental research design was applied. The study took 44 students of grade nine from Siraha district. The experimental group and control group were determined by tossing a coin. The experimental group was taught by using different instructional materials and control group was taught without using instructional materials

or just by chalk and talk materials. Pre-test was administered before the experiment started. The experiment runs for the duration of 15 days. After 15 days a post-test was administered on both groups and the mean scores was calculated. The difference of mean achievement scores are tested by using t-test at five percent level of significance. The results concluded that the achievement of the students of experimental group is better than the achievement of the control group.

Kshetri, (2011) studied on effectiveness of instructional materials in teaching geometry at lower secondary level. The main concern of this study was to compare to achievement of student taught by using instructional materials without instructional and find out the effectiveness of instructional materials on teaching geometry at lower secondary level. The design of the study was pre-test and post-test non-equivalent group design in Bardiya district. The population was 200 students. From the population, 48 students were selected from class eight as sample. The experimental group and control group were determined by tossing a coin. Both experimental and control groups were taught by researcher himself on the topic geometry at grade eight. The experimental group was taught by using different instructional materials and control group was taught without using instructional materials. Pretest was administrated before the experiment started. The experiment ran for 21 days. After 21 days, post-test was administered on both groups and the mean score was calculated. The difference of mean achievement score are tested by using t-test at five percent level of significance. Finally, the researcher concluded that the achievement of students of experimental group is better than the achievement of the control group.

Pandey, (2010) had research on use of instructional materials and its impact in teaching mathematics at primary level. The main concern of the study was to compare the mathematical achievement of the grade five students taught using teaching materials and

without using instructional materials. The design of the experiment is based on pre-test and post-test equivalent control group design. Two schools were selected purposively at Arghakhanchi district. From each school 20 students of grade five were selected for sample of the study. The experimental and control groups were determined by tossing a coin. Both the experimental and control groups ware taught by the researcher himself on the selected unite perimeter, area and volume, with and without teaching aids relatively. After teaching fifteen days, a post-test was administered. The difference of mean achievement scores are tested by using t-test at five percent level of significance. The results concluded that the students of experimental group performed better than the students of control group.

Khanal, (2008) had conducted a study about the effectiveness of manipulative material in teaching mathematics at primary level. The main concern of the study was to compare the achievement of the students taught by using manipulative materials with the achievements of the students taught without using manipulative materials and to find out the effectiveness of the manipulative materials in teaching mathematics at primary level. The pre-test, post-test nonequivalent group design was the design for this study. For this study, 40 samples of students from two school involving one control and another experimental group. Both the experimental and control groups ware taught by the researcher himself on the selected unit of algebra with and without using algebra tiles respectively. After completing the experiment, an achievement test was administered on both groups and mean scores were calculated. The results were drawn on the basis of t-test at one percent level of significance. It was concluded that the mean achievement score of the students taught by using algebra tiles was higher than the mean achievement scores of the students taught without using algebra tiles in teaching algebra.

Shrama (2007) in this study the availability and use of instructional materials in teaching mathematics at secondary schools of Syangja district. It took 34 schools for analysis. Descriptive statistics was used to analyze data. The results showed that the availability of instructional materials were below the required level.

Gautam (2005) conducted a study on 'Effectiveness of instructional materials in teaching mensuration at secondary level' to explore the effectiveness materials in teaching mensuration of secondary level and to compare the mathematics achievement of boys and girls in mensuration. Two public schools were taken from Rupendehi district. The sample had 28 students from both schools and the sampled students were inclusive according to gender and caste. Experimental research design was applied. The results show that experimental group performed better than controlled group.

The above mentioned researchers are related to the student's effectiveness of instructional materials and using manipulative materials. But none of these studies have been carrying out yet on the topic effectiveness of instructional materials in teaching mathematics, at grade eight in public school of Darchula district. It is to say there is a research gap at effectiveness of instructional materials in teaching mathematics at grade eight in public school in the Darchula district. So, the researcher motivated to carry out the research entitle.

Theoretical Review

Researches and theories are interrelated and inseparable. A theory provides a conceptual framework for research in terms contributes to the development theory. There are many theories about learning and development of children to get the achievement in mathematics. Here, we discuss briefly about the constructivism theory.

Constructivism Theory

Constructivism implies that learning should be individually constructed through active and connected learning strategies that are consistent with those of authentic pedagogy. Constructivism is an especially appealing learning theory for teachers who are trying to prepare students with skills that will enable them to succeed in a work place. In constructivism classroom, the students play a key role in directing learning. Learning occurs with teacher and learner both in the role of co-learners.

Constructivism is a theory of knowledge with roots in philosophy, psychology and cybernetics. It asserts two main principles whose application has far reading consequences for the study of cognitive development and learning as well as for the practice of teaching, psychotherapy interpersonal management in general. The two principles are: i) knowledge is not passively received but actively built up the recognizing subset, ii) the function of cognition is adaptive and serves the organization of the experiment of the word, not the discovery of ontological reality.

Seif, (2008) believes that constructivism is an approach to learning that puts emphasis on learner's activeness in establishing knowledge and comprehension. In a constructivist class mathematics teacher provides the students with real and meaningful problems and encourage them to present various solutions, seek help from classmates, and introduce the best solution. Such a teacher is not a knowledge transmitter or distributor but rather is a guide, facilitator, and assistant to the students. A constructivist teacher notices that the learners should be faced with the concept through a variety of methods and situations with different objectives and experiences so that they can perform better in producing and transmitting the constructed knowledge.

Constructivism theory recognized the importance of the mind in making sense of the material with which it is presented constructive particular in 'social ' form suggests that the learner is much more actively involved in a joint enterprise with the teacher of creating new meanings. Similarly, Kim, (2001) defined social constructivism as emphasizing the importance of culture and context in understanding what cocas in society and constructing knowledge based on this understanding.

Constructivist classes usually have an atmosphere like that of training workshops where students learn and teach from one another. They accept collaboration as a principle in learning. In this collaborative approach, teacher's role is to set a framework for students' learning and organize a discovery period in which students have direct relationship with materials and tools, and they learn how to learn. The teacher's role is that of a facilitator who intends to create the 'oh moment' which is the time when the student says 'I understood'.

In constructivist approach, being familiar the students' previous views and experiences, the teachers design situations in which the learners can reconstruct and expand their knowledge. The most important role that the teacher takes is to facilitate the process of knowledge construction. Those who can conduct different activities easily can help students with knowledge construction.

The teacher is a presenter, not a lecturer. A teacher is someone who explains the issues, presents models, and provides the collaborative groups with different activities. The teacher identifies the students' beliefs in formal and informal activities, interacts with them appropriately, and gives them special learning authorities. The teacher's guide the students toward idealization, encourage them to test their ideas, and praise conceptualization. Being aware of the students' perspectives, the teacher prepares the environment for the learners to experience things. The teacher is someone who encourages collaboration in order to

develop and enhance human relations and tolerance of different views. The teacher measures the effect of the provided exercises on students and examines the created expectations.

Beside his/her activities, the teacher helps the learners connect between two or more thoughts and ideas and create a meaningful method. Constructivism theory based on observation and scientific study about how people learn. It says that people construct their own understanding and knowledge of the world through experiencing things and reflecting on those experiences when we encounter some things new. According to Acharya (2017) constructivism stands on its three axioms that are as follows:

- Learners learn knowledge from their active participation.
- Learners given knowledge while reflecting on their own action.
- Learners give knowledge when they try to convey their solution to others.

From the above axioms, three terms actions can be taken, reflection and scaffolding to describe three broad aspects of constructivism psychological aspect, philosophical aspects, Piaget stresses the key word 'action through which he advocates that of knowledge is gained. He said that essential way of knowledge is not directly through our sense. Action is considered as the prime source of knowledge.

Constructivism theory states that knowledge construction is both social and cognitive process. Knowledge and meaning are actively and collaboratively constructed in a social constructivism process of discussion, negotiation and sharing. The theory also focuses on cultural influences on cognitive development that young children are curious and actively involved in their own learning and the discovery and development of new understanding.

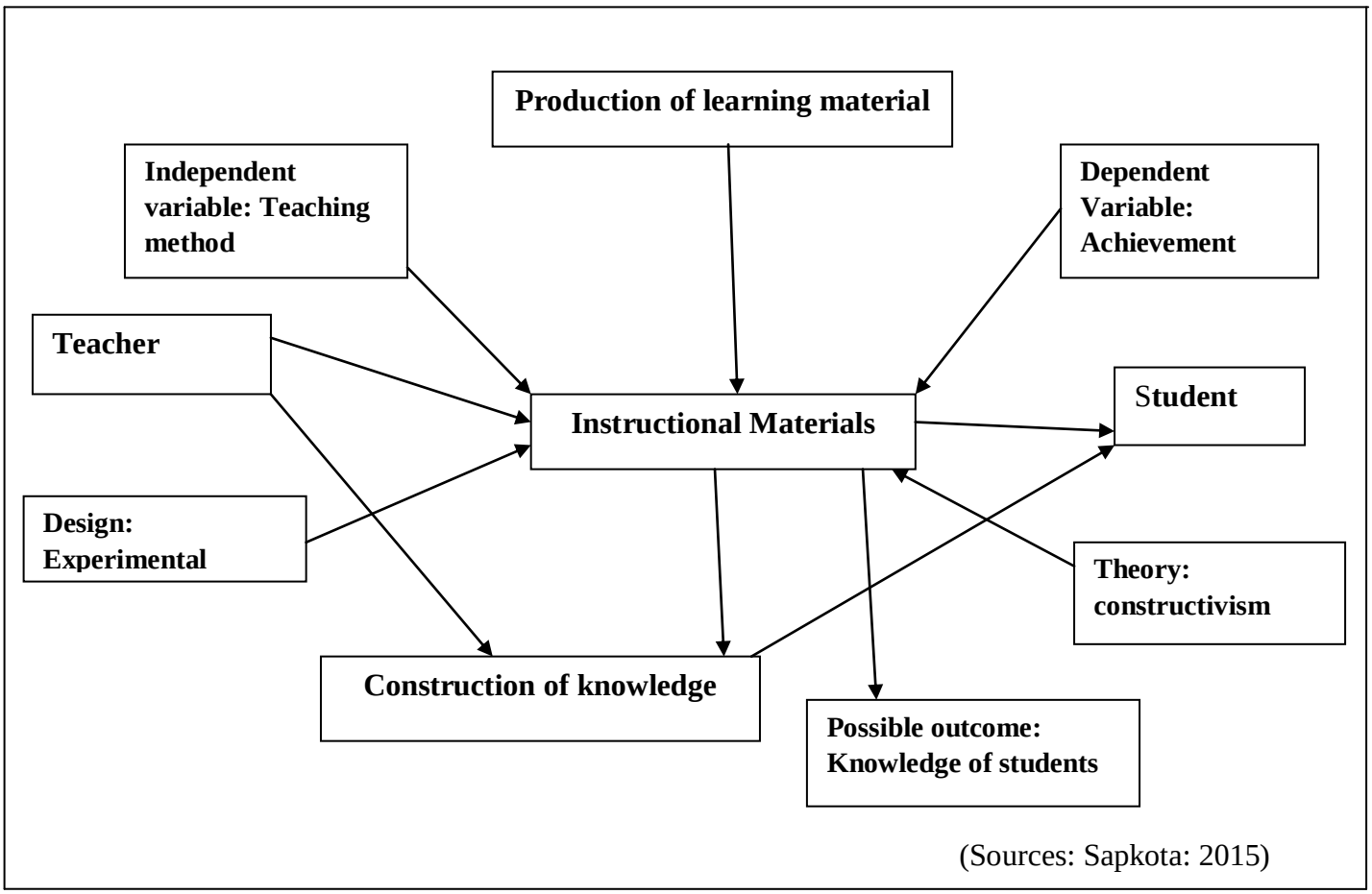
The social constructivist forms the epistemological backbone of this research. It is of immense importance for this specific research, as it guided and informed the manner in which this research was approached as it guided and interpreted. Constructive is an epistemology, learning or meaning making theory that offer an explanation of the nature of knowledge and new learners. The real understanding is only constructed based in learner's previous experience and background knowledge. It maintains that individuals create or construct their own need understanding or knowledge through the interaction of what they already believe and the ideas, events, and activities with which they come into contact. The teacher is a guide, a facilitator, and explorer who encourage learners to question, challenge and formulate their own ideas, optional and conclusions (Ciot, 2009). In this context, instructional materials help in construction theory. In the existing pedagogy the role of teacher is dominating the role of students. The teacher is main actor of teaching. When teacher remains absent in any day the teaching learning process does not take place, whereas when student remain absent the teaching learning process takes place. The teaching environment is created in such a way that students have to be present at the predetermined time place. It can be said the existing pedagogy is neglecting the student's desires and their needs. Not only this, the pace of learning also depends on the teacher.

In existing pedagogy the power is centered to the teacher and on administration. In other words the teacher exercises his power over students by controlling the time and place (as fixed by administration) as well as pace of learning. The present pedagogy is designed using the theoretical base and instructional materials as the tools of learning.

Conceptual Framework of the Study

A conceptual framework is the representation either graphically or narrative form of the main concept or variable and the relationship of the independent variable with dependent variable**.** The conceptualized framework of instructional materials is given below.

Figure: Conceptual Framework of the Study



The above mentioned shows that instructional materials were used as tools which are used to produce learning aids by teacher and they are helpful to construct knowledge by students as well as to connect teacher and students for knowledge construction. The knowledge is constructed by students through their active base learning. Teacher plays the role of facilitator in the process of knowledge. Furthermore above mentioned figure shows that the students achievement are dependent variable and teaching method where were used by using instructional materials is independent variable. Likewise the figure shows that the design of the research is given that is experiment.

Chapter-III

METHODS AND PROCEDURES

Research methodology is a science, which determines how the research becomes complete and systematic. In this chapter, design of the study, population of the study, sample of the study, sampling procedure, tools of data collection, independent and dependent variables, affecting variable and controlled exercise in the experiment, reliability and validity of the test, data collection procedure, method of data analysis and interpretation , have been described and discussed**.**

Design of the Study

The study is based on experimental research design. So, there were two groups-experimental and control. Experimental group was taught by using instructional materials whereas control group was taught by using usual daily teaching materials. The pre-test and post-test equivalent group design was adopted. Similarly, motivation towards mathematics class was gauged by Likert scale comparing with both groups. Two groups were made homogenous based on gender ethnicity, age, pre-achievements. In this study, the researcher used pre-test post-test, non-equivalent group design. The diagram of the design is as follows:

Table No. 1

Design of the Study

Group	Pre-Test	Treatment	Post-Test
E_R	O_1	✓	O_2
C_R	O_3	×	O_4

Where,

E_R= Randomized experiment group.

C_R= Randomized control group.

O_1&O_3= Pre-test for experimental group and control group respectively.

O_2&O_4=Post-test for experimental group and control group respectively.

✓ = Treatment (teaching with using instruction materials)

× = Control (teach in without using instructional materials) this design is one of the effective designs to minimize the threats to experimental validity.

The design involved students from intact classes. The study made use of experimental group and the control group. The experimental group was taught with Geometric by using materials while the control group was taught without using materials. On the basis of the pre-test result, top rank to bottom rank, I divided experimental and the control groups. The instrument for data collection was an achievement test which comprised a 20 item questions developed by the researcher and based on the selected contents in the pry-many curriculum which proved for the students over the years.

A pre-test on mathematics achievement on the selected topics was administered by the researcher to ascertain the present level of achievement of the control and experimental groups of students. After the pre- test, the researcher commenced the experimental in the selected schools, adhering strictly to the topics. The experimental group was taught with Geometric box geoboard. The control group was taught without using the instructional materials. Lasted 2weeks after which the same instrument was administered on the two groups as post- test. This design is the most effective in minimizing the threats to experimental validity. Two groups were made homogeneous as nearly as possible was tested by computing the ratio of the two samples variances based on pre-test. Experimental group was received the new treatment whereas the control group received the convention

treatment. The experimental group was taught by Geometry tiles in teaching Geometry as control group was taught by traditional method of teaching.

Population of the Study

The population of the study was consisted of all students of grade eight of public schools of Darchula district.

Sample of the Study

This was experimental study. Researcher has chosen one of the school, from Darchula district Shree Galainath Secondary school (Jharakada) was taken as sampling school and the grade eight students were taken as sampling unit. There were 50 students in grade eight in the academic session 2074.

Sampling Procedure

The total number of students which is 50 were sub divided into two categories- experimental and control group. Non- Random sampling method was used to select students for these two groups.

Tools of Data Collection

A set of questions contains 20 marks were prepared to examine the achievement scores. Achievement Tests which was administered at a pre-test and post-test. The test administered to grade VIII students in the experimental and control groups after the end of 15 days of teaching.

Achievement Test

An achievement test paper was the main instrument for data collection of the study. The pre-test achievement test had used to determine the achievement level of the students of both groups. This test had consisted of twenty questions to be solved. The post

achievement test contains twenty questions that have a slightly different with the question in the pre achievement test, but the questions were in the same structure. Post achievement test had used to measure the student achievement after using Geoboard, Geometric chart Scale, compass, pencil etc. There had involved both the control group and the experimental group.

Interview Guideline

The researcher used interview guideline to obtain the reflection of students and teacher about use of teaching materials. Interview is a two-way interaction between interviewer and interviewee in which interviewer creates situations that can attract the attention of respondents for a enough period of time in asking questions and answering the questions which interviewee puts his/her understanding and meaning. To go in-depth of the information, I carried out the open ended interview guideline. I took interview of teacher and students using interview guideline.

Independent and Dependent Variables

Independent Variables: The values that can be changed or controlled in a given model or equation. They provide the "input" which is modified by the model to change the "output". An independent variable is the variable that is changed or controlled in a scientific experiment to test the effects on the dependent variable. It is a variable that stands alone and isn't changed by the other variable you are trying to measure.

Dependent Variables: The values that result from the independent variables. A dependent variable is the variable being tested and measured in a scientific experiment. Just like an independent variable, a dependent variable is exactly what it sounds like. It is something that depends on other factors.

In this study teaching materials and teaching methods are considered as the independent variables and student achievement considered as the dependent variable and

all the independent variables like teachers quality, student –teacher relation in teaching, teacher's behavior, qualification of teacher effects on the achievement of students is dependent variable in this study.

Affecting Variable and Controlled Exercise in the Experiment

Different variable at tested the validity of the researchers activity central variable cannot be control directly some of variables maturation, history, time interval testing effect and statistical mortality was controlled through this design of the experimental and other different variables was controlled by the following ways. Instructional materials in teaching approaches and achievement were the dependent and independent variable respectively.

Teacher's Variable

Researcher himself taught both experimental and control groups. He taught for Separate two groups and same unit, which controls certain variable such as teacher's qualification emotion and other variables.

Subject Matter

The content was taught to both experimental and control groups from the same curriculum.

Teaching aid Used

Researcher used same teaching methods for both groups. And used innovative instructional materials for experimental groups whereas, traditional teaching materials for control groups.

Students

Both groups were selected from class VIII of the same school. Students in both groups were different. Control group were using traditional method teaching and an experimental group were using experimental method of teaching.

Evolution Applied

After the end of the experiment, the same test was given to the experimental and control groups. The researcher himself marked the test paper of the student. And compare the scores obtained by experimental group and control group. For pilot study of test item, researcher took the test in Shree Galainath Secondary school Jharkada -8 Bhoharigoun Darchula.

Length of Experiment

The researcher divided equal time duration to teach both experimental control groups. The researcher taught into two groups namely, experimental and control groups. Then the researcher teach two weeks by using innovative instructional teaching materials for experimental and two weeks by adopting traditional teaching methods for control group.

Reliability and Validity of the Test

The validity of data collection tools of the study ensures on the basis of, spilt half method, to ensure the reliability, the researcher piloted on10 Students of community school, Jharkada of Darchula district. Before administrating the test paper researcher gave instruction about how to answer the given questions. The test consisted thirteen items, very short (4 questions having 1 mark pre question), Short questions (5 question having 2 marks) and long question (4 question having 4 marks) the efficient of reliability was found 0.96by correlation coefficient. It indicates that there is strongly high reliability in the statements by Karl Pearson's scale. It shows that achievement test paper was reliable. Thus, the calculation of reliability table is presented in (Appendix-D).

$$\text{Reliability of the full test}=\frac{2\times\text{Reliability on}\frac{1}{2}}{1+\text{Reliability on}\frac{1}{2}}$$

To calculate reliability of the value even and odd group were found 0.96.Since the reliability is always in -1 to +1. The greater value of the tool of measurement the greater the reliability of measure but the smaller value of the tool of measurement the smaller the reliability. Generally, reliability coefficient was interpretation following.

0 = completely not reliability

± (0.1-0.20) = strongly low reliability

± (0.21-0.40) = low reliability

± (0.41-0.60) = medium reliability

± (0.61-0.80) = high reliability

± (0.81-0.99) =strongly high reliability

± 1 = completely reliability

Therefore, calculated reliability coefficient are in ± (0.81-0.99). Thus, the measurement tools of the groups were strongly high reliability.

Data Collection Procedure

One of the most important and essential step to answer the research question is the data collection procedure. Without collecting the data no information about the study can be obtained. In this study the researcher collected data to measure student's motivation and their achievement in mathematics. The researcher collected quantitative data to measure the achievement and student's motivation towards mathematics.

The experimental and control groups would be taught by researcher herself at least 30 teaching hours of 45 minutes per group per teaching hour. The experimental group was taught by using special instructional materials whereas control group was taught by usual

instructional materials. At the end of teaching, mathematics achievement test was administered to both groups and the answer sheet was scored and tabulated for analysis.

Method of Data Analysis and Interpretation

The collected information was coded, tabulated for further analysis. Data was analyzed by using different statistical tools and techniques like mean, variance and standard deviation. The mean differences of test achievement between the two groups were analyzed by using t-test at 0.05 level of significance. When the samples are small and their variance are equal nearly we can use method of pooled variance to test the significance difference between two independent means, the critical value of t-test is found for $N_{1+}N_2$-2 degree of freedom.

Mean variance and standard deviation of the data of both groups was calculated on the basis of the scores on the achievement test. The t- test was applied to ensure the significance difference between two group achievement scores. The statistical formulae used to calculate mean standard deviation, and t- value. The formula of t-test as follows,

$$t = \frac{X1-X2}{Sp\sqrt{\frac{1}{N1}+\frac{1}{N2}}} \quad \text{Where } Sp = \sqrt{\frac{S1^2(N1-1)-S2^2(N2-1)}{N1+N2-2}}$$

Where x_1 = Mean score of Control group students x_2 = Mean score of Experimental group students.

N_1 = Number of students in Control group. N_2 = Number of students in Experimental group.

S_1^2 = Variance of Control group students. S_2^2 = Variance of Experimental group students.

Chapter-IV

ANALYSIS AND INTERPRETATION OF DATA

This is an experimental research related to find out the effectiveness of instructional materials in teaching mathematics at lower secondary level of grade VIII. The objectives of this study were "To compare the achievement of students taught by using instructional materials and without using instructional materials" and "To compare the student's motivation towards mathematics learning with and without using instructional materials". Pre-test, post-test, non-equivalent group design were adapted. For this 50 students were taken as sample of Shree Galenath Secondary School Jharkada, as experimental and control groups respectively. The main tools of data collection were achievement test papers and interview guideline. Pre-test was administered before the experiment started and the post-test was administered after the experiment. Then comparing the achievement score of pre-test and post-test of both groups were analyzed using t-test and Split-half method to find the reliability, at 0.05 level of significance. The data scores on achievement test were analyzed by using quantitative technique.

Comparison of Mean Achievement Scores of Experimental and Control Groups

The research was experimental in nature. The achievement test was the basic tool for data collection to achieve the result for the objectives. 50 students from Galanath Secondary School Jharkada were selected. Research was intended to explore the effectiveness of the Geometry materials Geoboard, Geometric chart, Scale, Protractor, compass pencil in teaching mathematics in this study. The obtained data were analyzed and interpreted under the following headings:

Analysis of Pre-Test Result

Score of the pre-test of students of the experimental and control groups have been given in Appendix-B together with the statistical calculation of mean, standard deviation and variance. The pre-test analysis for the comparison of the mean achievement scores of pre-test has been summarized in table.

Table-2

Comparison of Experimental and Control Groups on Pre-test Score

Group	N.	Mean	Standard Deviation	Variance	t-value	Level of significance	Remarks
Experimental	25	6.68	3.69	13.62	-0.03	0.05	$H_0$is Accepted
Control	25	6.72	3.58	12.88			

The table 2 shows that the mean, standard deviation and variance of the experimental and control groups on the pre-test. The mean score of experimental group was 6.68 and the mean score of control group was 6.72. The standard deviation of experimental group was 3.69 and the standard deviation of control group was 3.58.The variance of experimental group was13.62and the variance of control group 12.88. Mean achievement scores of both groups were compared statistically using two tailed t-test at 0.05 level of significance. The table shows that the calculated value of t-test was -0.03 which is less than the tabulated value 1.96 at 0.05 level of significance with dree of freedom (N_1+N_2-2)=25+25-2=48.So the null hypothesis was accepted. This shows that there is significant difference existed between the experimental and control groups on pre-test scores.

Analysis of Post-test Result

The post-test was administered to both experimental and control groups after the treatment was given. The post –test scores of students of experimental and control group had been presented in Appendix -C. The calculated value of mean, standard deviation variance and t- value had mentioned in following table 3.

Table: 3

Comparison of Experimental and Control Groups on Post-Test Score

Group	**Number**	**Mean**	**Standard Deviation**	**Variance**	**t-value**	**Level of signification**	**Remarks**
Experimental	25	12.08	4.48	20.15	3.74	0.05	$H_1$is Accepted
Control	25	7.92	3.34	11.21			

The above table indicates that mean, S.D. and variance are different. The mean scores of experimental group was found to be 12.08 and the mean score of control group was 7.92, The standard deviation of experimental group was 4.48 and standard deviation of control group 3.34 and variance are 20.15 and 11.21 respectively. The difference in the mean achievement between experimental group and control group is found to be 4.16.In order to see whether initial difference is existed between two groups t-test was employed with 0.05 level of significance. The above table shows that the calculated value of t-test was 3.74 which is greater than the tabulated value 1.96 at 0.05 level of significance. The result of the t-test does not support the null hypothesis that there is no difference between mean achievement scores of experimental and control group on post –test scores. It supports alternative hypothesis of their existence of the difference. Analysis of the pre-test

scores indicated that the groups were comparable at 0.05 level of significance. The batter performance of experimental group over control group on the post-test scores might have been attributed due to use of geometry Geo-board, Geometric chart, Scale, Protractor, compass, pencil and given to experimental groups in the reference of control exercised in the experimental. This means after conducting the treatment both groups experimental and control had different level of achievement scores in mathematics.

Achievement between Control and Experimental Groups

The pre-test and post-test scores of 50 students experimental and control group are presented and the summary of statistical calculation for both groups on the pre-test and post-test are presented in the table.

Table: 4

The Comparison base on the Total Average

Group	**Pre-test (Mean)**	**Post-test(Mean)**	**Pre-test (Variance)**	**Post-test (Variance)**	**Pre-test (SD)**	**Post-test (SD)**
Experimental	6.68	12.08	13.62	20.15	3.69	4.48
Control	6.72	7.92	12.88	11.21	3.58	3.34

In this achievement of the students are observed and macro level of comparison between the achievement of the experimental and control groups is presented. The above table shows that the mean score of the students of experimental groups is increased by 5.4 averages out of 20 marks of 25 students. Mean score of the control group is increased by 1.2 averages out of 20 marks of 25 students. The progress rate of control group was only 1.2 averages which is very low in comparison with mean score of experimental group (5.4

average). The whole achievement scores of experimental group performance was more than the control group because the SD value of scores of the experimental group was 4.48 in comparison to 3.34 of control group. Thus, the researcher concludes that the achievement of the grade VIII students, who were taught geometry with using innovative teaching methods, achieved better achievement than the students who were taught by using traditional teaching methods.

Comparison of Student's Motivation towards Mathematics between the Experimental and Control Group

To analyze the data obtained by mathematics motivation scale, then the mean, variance, standard deviation of each individual for experimental and control groups were calculated. The mean, variance and the standard deviation of the experimental group were 19.68, 34.76 and 5.89 respectively. Similarly, the mean, variance and standard deviation of the control group were 17.52, 31.76 and 5.63 respectively. The value of t- test of pooled variance was used to test the significance difference on the students' motivation of two groups. The calculated value of t-test was 1.32 and tabulated value of t was 1.96 at 0.05 level of significance. These results are presented on table 5.

Table 5

Result of Motivation Scale on Two Groups

Group	**Mean**	**Variance**	**Standard deviation**	**t-value**	**Level of signification**	**Tabulated t-value**	**Remarks**
Experimental	19.68	34.76	5.89	1.32	0.05	1.96	H_1 is Accepted
Control	17.52	31.76	5.63				

Since 1.32<1.96, the Null hypothesis, "students of the experimental group and students of the control group are equally motivated towards mathematics" was rejected and the alternative hypothesis, "the students of experimental groups were more motivated on mathematics than the students of control group" was accepted.

Qualitative Analysis and Interpretation of the Students' Motivation towards Mathematics

Qualitative analysis is made on the basis of observation reports made by the researcher. On the basis of class room instruction the researcher observe the students activities and noted daily. Geometry provided the opportunities for divergent thinking and creative problem while developing student logical thinking abilities. Students experienced that form geometric materials it helped them learning vocabulary, properties of geometry laws. Geoboard, Geometric chart, scale, protractor, compass, pencil help them and challenged to find alternative solutions. It also helped them to communicate their thinking in Geometry. On the other hand, teaching Geometry in control groups without use of instructional materials Geoboard was less interesting and motivating to clarify Geometry concept. It was also difficult to activate students as well as to create interest in the problem.

Researcher requests the subject teachers to observe her class and provide the feedback. Along the period of experimental group the subject teachers were stayed in the same class in both groups. Experimental group teacher gave positive response about teaching. In experimental period, subject teacher and students of experimental group had given thanks for teaching by using geoboard, Geometric chart, scale, protractor, compass, pencil etc. The researcher concluded that it was possible due to the Geoboard.

Similarly, the researcher had found that her teaching was no effective in control group as much as experimental group by analysis of result of data, class observation, class

activity and class note. The student of control group were not serious and interpreted to read this topic seriously.

In the experimental group the researcher found that the teacher and student had engaged their time to interest, sharing information to each other openly by which they learn in the better way while solving their mathematical problems.

In qualitative information, the interviews were taken from the selected students and mathematics teacher to derive qualitative information. The researcher asked some question and collected the answer, which is given below:

Researcher: what type of effect did you find from the class conducted by using instructional materials?

Subject teacher: Student become active in teaching activities. They were interested in subject matter and much more interested in teaching learning activities'.

Researcher: what type of different did you find in teaching between using instructional materials and without using instructional materials?

Student 'a': learning mathematics using instructional materials is easy to understand and interesting class.

Student 'b': I felt that the learning becomes long time obtained by using instructional materials.

Student 'c': instructional materials helps for all students to understand subject materials.

The answer of the above questions shows that the use of instructional materials in teaching geometry is effective than without using instructional materials.

During experimental period researcher had found that every student of experimental group were curious and interested to learn mathematics seriously and all of students that group were not making noise and also, they told me to teach regularly and called me time to time to teach. Similarly researcher had found that her teaching was not effective on control group because students of control group were not interested in learning in the same way as usual. Hence, the researcher found that there were active participation of the students in experimental group of the students and they enjoyed teaching learning activities.

Chapter-V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

The research was experimental in nature. The purpose of this study was to test the effectiveness of instructional materials in teaching mathematics. The first section of this chapter presents the summary of the study, the second section presents its findings, conclusion and the last section presents recommendations based on the findings of the study.

Summary of the Study

This study was concerned with the study of effectiveness of teaching mathematics by using instructional materials at lower secondary level. For this study, the researcher developed test items with the help of prescribed curriculum and the textbook of mathematics of grade eight. The researcher administrated test in Shree Galaenath Secondary School Jharkada (Darchula) for achievement test. Test paper was the main instruments used for study.

For the study, the researcher selected Darchula Shree Secondary School Jharkada for experimental and control group by dividing two groups. Each group had contained 25 students. At first pre-test was administered on both groups. Then the experimental group was taught by using instructional materials and the control group was taught without using instructional materials. The score of 25/25 students were analyzed by using the mean, variance, standard deviation ,and t-test for independent simples under comparison of achievement score of experimental and control group on pre-test and comparison of achievement score of experimental and control group on post-test.

Findings

On the basis of the analysis of the scores obtained by students, the researcher found in this study that the mean achievement score of the students taught with using instructional materials is higher than the mean achievement score of students taught without instructional material. Statistically the mean difference was significant. Thus the researcher concluded that the use of instructional materials was effective in teaching geometry at lower secondary level.

- T-test was used to compare mean scores of experimental group and control group on pre -test. The results of the test indicate that there was no significant difference between the groups at 0.05 level of significant.
- The mean score of the post-test results of experimental group and control group were not same. The mean score of experimental group is 12.08 and control group is 7.92.
- The study indicated that the mean scores of the students of experimental group is significantly higher than the mean score of control group.
- The achievement of grade VIII students who were taught mathematics using geometry materials geo-board, Geometric chart, scale, protractor, compass, pencil achieve better score then the students who were taught without using geometric materials.
- The mean achievement scores of student taught with using geometric materials is higher than mean achievement score of the student taught without using instructional materials on post-test.
- The student of experimental group were found curious and highly interested in teaching learning activities than that of control group.

- Student felt pleasure while teaching mathematics using geometric materials.

Conclusions of the Study

From the finding of the study, it could be concluded that students taught using instructional materials performed significantly better compared to the control group. The researcher found that the mean achievement score of pre-test was as nearly same on both group without using instructional materials but the mean achievement score of students taught with using different instructional materials was higher than the achievement score of the students taught without using instructional materials in post-test. The student of control groups felt bored and lazy to learn mathematics without instructional materials. But the students of experimental group were so curious and interested in learning mathematics with using instructional materials. it was concluded that the instructional materials affected with the teaching and learning. This shows that the students who were taught instructional materials are more active, regular, participating in all activities of classroom than the student who were taught without using instructional materials. So the instructional materials helps the students to understand the problems in mathematics. Hence the use of instructional materials in teaching learning activities in mathematics is found effective.

Recommendations

On the basis of finding of this study some measures have been recommended for the improvement of the teaching situation at lower secondary as given below:

- This study recommends that since children taught mathematics using geometric materials perform better than those who are taught mathematics using geo-board, scale, protractor, compass, pencil children should be taught by using geometric materials for the batter performance in mathematics.

- Teacher should be confident that which materials to be used while teaching mathematics because all student have not their equal teaching –learning capacity.
- The mathematics teacher should try to use instructional materials in teaching mathematics.
- The teacher, students, textbook writers and methodologists can modify their views or approach in the light of the information provided.

Suggestions for Further Researcher

"Geometric materials must be used at the right time and in the right way, if they are to be effective" The materials must be selected with the mathematical purpose in mind. Based on findings and the scope of the study, suggestions for further studies to be carried out the following areas:

- The large research studies must be designed and carried out in order to investigate the effectiveness of using materials in sample in various schools of different part of Nepal.
- A similar study can be carried out in other branches of school mathematics.
- Similar studies including the opinions and attitudes of parents', teachers and students should be carried out.
- The present study was related to topic Geometry. Similar studies may be done with other topic.

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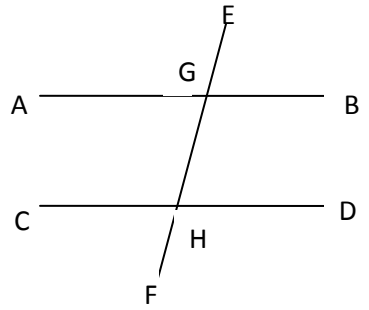
Appendix A –A_1

Achievement Test (for Pilot-test)

कक्षा :- ८ **पूर्णाङ्क :-३०**
विषय : गणित -ज्यामिति) **उत्तीर्णाङ्कः- १**
समय :- १ : ३० मिनेट

समुह (क) [4 x 1] = 4

प्रश्न १दिइएको चित्रबाट $\angle EGB$ को संगति कोण लेख :



प्रश्न २ त्रिभुजको दुईवटा कोणहरुको नाप क्रमश 50^0 र 60^0 छन् भने तेस्रो कोणको नापकति हुन्छ ?

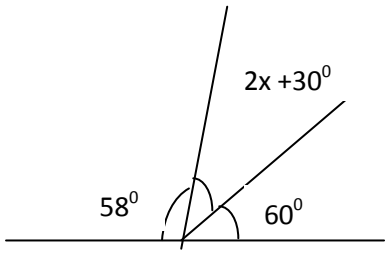
प्रश्न ३ आयतका प्रत्येक कोणहरु कति डिग्रीका हुन्छन् ?

प्रश्न ४ चार ओटा भुजा मिली बनेको बन्द आकृतिलाई के भनिन्छ ?

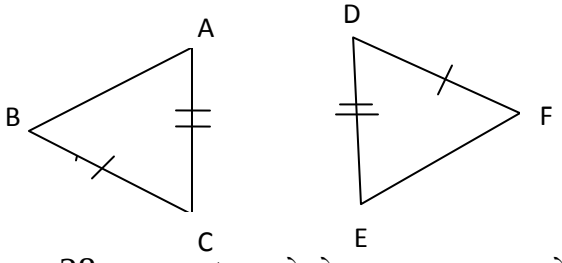
समुह (ख) [5 x 2 = 10]

प्रश्न ५ स्केलको प्रयोग गरी AB = 5cm, BC = 4 cm र AC = 6cm भएको त्रिभुजको रचना गर

प्रश्न ६ दिइएको चित्रमा x को मान निकाल्नुहोस् ।

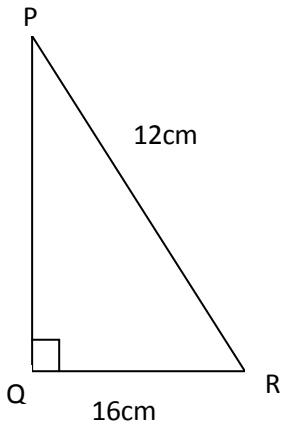


प्रश्न ७ दिइएको चित्रमाΔABCर $\Delta\ DEF$ कुन तथ्य अनुसार अनुरुप हुन्छ ?AB को संगति भुजाको नाम निकाल्नुहोस्

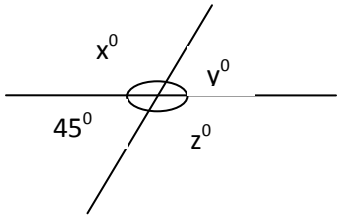


प्रश्न ८ व्यस 28 cm भएको वृत्तको क्षेत्रफल पत्ता लगाउनुहोस्

प्रश्न ९ दिइएको समकोण त्रिभुजको क्षेत्रफल निकाल्नुहोस ?



प्रश्न १० दिइएको चित्रमा X, Y र Z कोणहरुको मान पत्ता लगाऊ ।



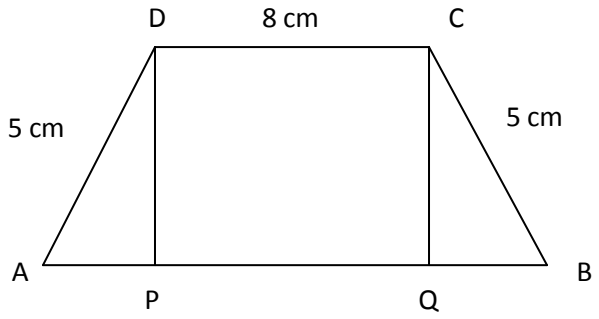
समुह (ग) [४ x ४ = १६]

११. समबाहु त्रिभुजको प्रत्येक कोण ६०° हुन्छ भनी प्रमाणित द्वारा सिद्ध गर्नुहोस (दुईवटा फरक फरक नापका चित्रहरु अनिवार्य छन्)

१२. एउटा भुजा ४ से.मि. भएको नियमित पञ्चभुजको रचना गर :

१३. आयत र वर्गका फरक गुणहरु के-के छन् पत्तालगाऊ ।

१४. दिइएको चतुर्भुज ABCD को क्षेत्रफल पत्ता लगाऊ ।



Appendix –A_2

Achievement test (for Pre – test)

कक्षा :- ८

पूर्णाङ्क :- २०

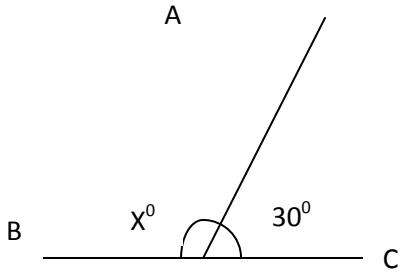
विषय : गणित (ज्यामिति)

उत्तीर्णाङ्क :- ८

समय :- ३०मिनेट

प्रश्न १ दिइएको चित्रमा x को मान कति हुन्छ ? [20 x 1 = 20]

क) १५०° ख) १२०° ग) १३०° घ) १६०°



प्रश्न २ यदि कुनै वृत्तको अर्धव्यास 'r' cm भए त्यसको परिधि को नाप कति हुन्छ ?

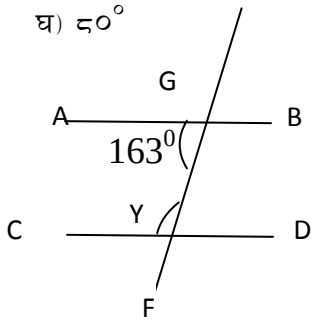
क) πr ख) $2\pi r$ ग) πr^2 घ) $\frac{4\pi}{3\pi}$

प्रश्न ३ यदि कुनै वृत्तकार रोटीको व्यास १४ से.मी. छ भने उक्त रोटीको क्षेत्रफल कति होला?

क) १५४ वर्ग एकाइ ख) १५० वर्ग एकाइ ग) ४९ वर्ग एकाइ घ) ४४ वर्ग एकाइ

प्रश्न ४ दिइएको चित्रमा 'Y' को मान कति हुन्छ ?

क) ३०° ख) ४०° ग) १६०° घ) ८०°



प्रश्न ५ तिन ओटै भुजा बराबर भएको त्रिभुजलाई के भनिन्छ ?

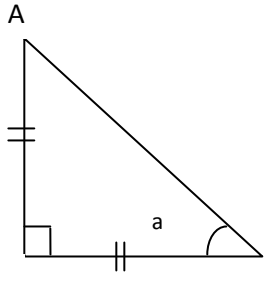
क) समबाहु त्रिभुज ख) समद्विबाहु त्रिभुज ग) विषमभाव त्रिभुज घ) कुनै पनि होइन

प्रश्न ६ आयतको क्षेत्रफल निकाल्ने सूत्र के हो ?

क) A = l x b ख) $A = l^2$ ग) $A = \frac{1}{2}bh$ घ) 2(l + b)

प्रश्न ७ दिएको चित्रमा 1° को मान कति हुन्छ ?

क) ३०° ख) ४०° ग) ४५° घ) ६०°

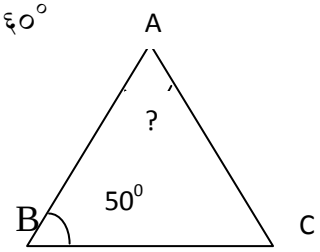


प्रश्न ८. १४ से.मी. व्यास भएको वृत्तको परिधि कति हुन्छ ?

क) 44 cm ख) 45cm ग) 88cm घ) 22cm

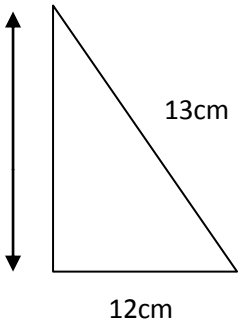
प्रश्न ९ दिइएको ΔABC मा ΔBAC को नाप पत्ता लागउनुहोस् ?

क) ८०° ख) ५०° ग) ४५° घ) ६०°



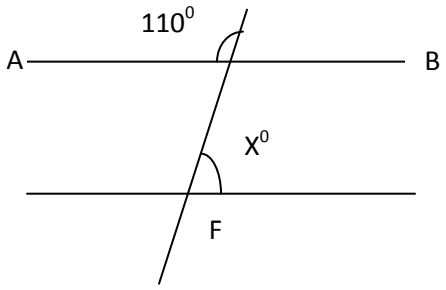
प्रश्न १० दिइएको चित्रमा AB को लम्बाई पत्ता लागाउनुहोस् ?

क) 6 cm ख) 5cm ग) 4cm घ) 3cm

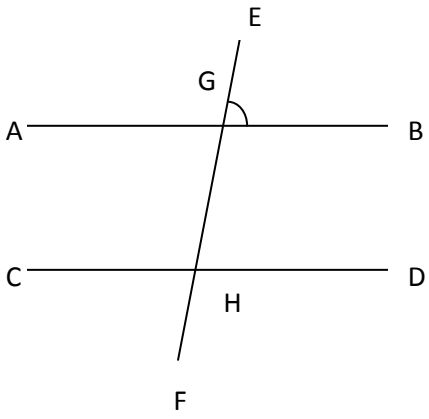


प्रश्न ११ संगैको चित्रमा $AB||CD$ भएको x^0 को मान पत्ता लागाउनुहोस ।

क) ७०° ख) ७५° ग) ६०° घ) ८०°



१२. दिइएको चित्रमा ΔBGE को संगत कोण कुन हो लेख्नुहोस्

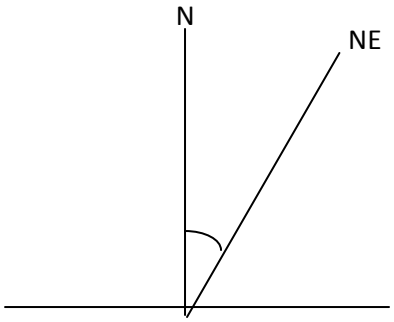


क) ΔDHG ख) ΔACH ग) ΔAGE घ) ΔFHD

प्रश्न १३ वृत्तको परिधी निकाल्ने सूत्र लेख्नुहोस् ।

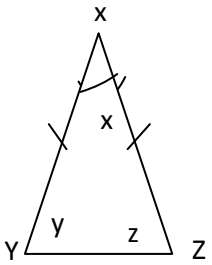
क) $2\pi r$ ख) $\pi \mathrm{r}^2$ ग) $\frac{\pi \mathrm{r} 2}{2}$ घ) πr

प्रश्न १४. NE ले जनाउने कम्पास दिशा स्थितिलाई कोणमा लेख्नुहोस् ।



क) ३०° ख) ४०° ग) ५०° घ) ६०°

प्रश्न १५ तल दिइएको त्रिभुजका प्रत्येक कोणहरु कति डिग्रीका छन् ?



क) ५०° ख) ६०° ग) ६५° घ) ३०°

प्रश्न १६ दुई ओटा रेखाहरु आपासमा काटिदा बन्ने कोणलाई के भनिन्छ ?

क) परिपुरक कोण ख) आसन्न कोण ग) समपुरक कोण घ) शीर्षाभिमुख कोण

प्रश्न १७ दुइओटा सामानान्तर रेखाहरुलाई छेदकले काट्दा बन्ने क्रमागत भित्री कोणहरुको कति हुन्छ ?

क) ६०° ख) ८०° ग) १६०° घ) १८०°

प्रश्न १८ अर्धवृत्तको क्षेत्रफल निकाल्ने सूत्र के हो ?

क) $\frac{\pi r^2}{2}$ ख) πr^2 ग) $2\pi r$ घ) πr

प्रश्न १९ वृत्तको कति ओटा केन्द्रविन्दु हुन्छन् ?

क) १ ख) २ ग) ३ घ) ४

प्रश्न २० वृत्तको परिधि निकाल्ने सुत्र कुन होला?

क) $2\pi r^2$ ख) πr ग) πd घ) πr^2

Appendix– A_2

Achievement Test (for Post – test)

कक्षा :- ८ **पुर्णाङ्क :- २०**

विषय : गणित (ज्यामिति) **उत्तीर्णाङ्क :- ८**

समय :- ३० मिनेट

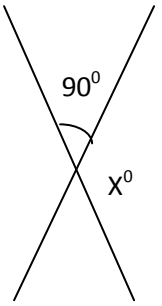
१. त्रिभुजका तिन ओटा भित्रिकोणहरुको योगफल कति हुन्छ ? [20 x 1 = 20]

क) १८०° ख) ९०° ग) २७०° घ) ३६०°

२. कुन त्रिभुजका तिन ओटा भुजाहरु बराबर हुन्छन् ?

क) समबाहु त्रिभुज ख) समद्विबाहु त्रिभुज ग) विसमबाहु त्रिभुज घ) कुनै पनि होइन

३. दिएको चित्रबाट X^0 को मान कति हुन्छ ?

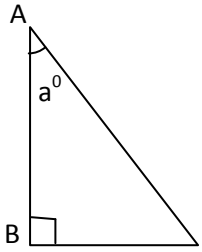


क) ९०° ख) १८०° ग) ०° घ) ३६०°

४. यदि आयतको लम्बाई 20 cm र चौडाई 10 cm भए सो आयतको क्षेत्रफल कति हुन्छ ?

क) $100\ cm^2$ ख) $150\ cm^2$ ग) $200\ cm^2$ घ) $300\ cm^2$

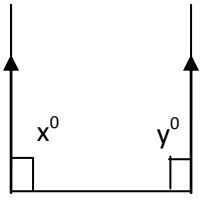
५. दिएको चित्रबाट a^0 को मान कति हुन्छ ?



क) ३०° ख) ४०° ग) ४५° घ) ६०°

६. दिएको चित्रबाट $x^0 + y^0$ को मान कति हुन्छ ?

क) ९०° ख) १८०° ग) २००° घ) ३६०°



७. तलको मध्ये कुन मिल्दैन?

क) त्रिभुज ख) वर्ग ग) पञ्चभुज घ) वृत्त

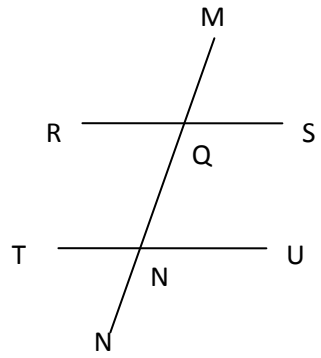
८. समबाहु त्रिभुजको प्रत्येक कोण कति डिग्रीको हुन्छ ?

क) ३०° ख) ६०° ग) ९०° घ) १८०°

९.वृत्तको कतिओटा केन्द्रविन्दु हुन्छन् ?

क) १ ख) २ ग) ३ घ) ४

१०. दिएको चित्रमा$\angle SQP$ को एकान्तर कोण कुन हो ?



क) $\angle TPQ$ख) $\angle MQP$

ग) $\angle TPN$घ) $\angle UPN$

११. आयतको क्षेत्रफलनिकाल्ने सूत्र कुन हो ?

क) l x b ख) πr^2 ग) πr घ) $2\pi r$

१२. दुई ओटा सिधा सामानान्तर रेखाहरुलाई एउटा छेदकले काटदा बन्ने क्रमागत भित्री कोणको योगफल कति हुन्छ ?

क) ९०° ख) १६०° ग) १८०° घ) ३६०°

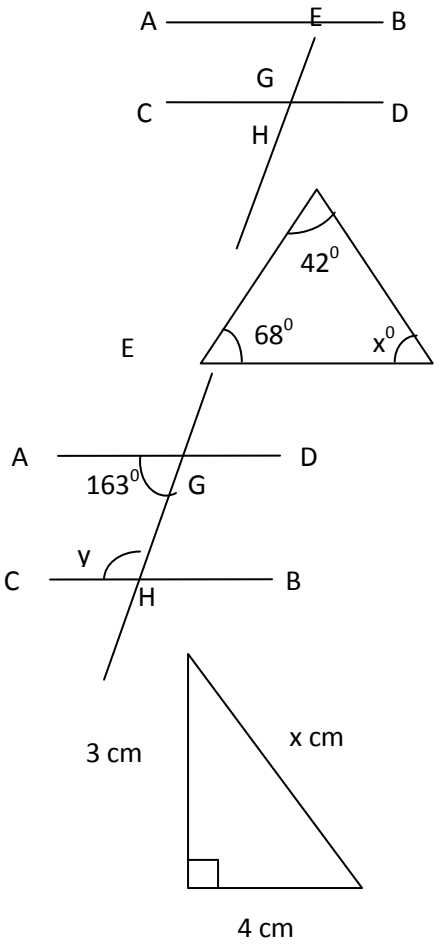
१३. त्रिभुजका बाहिरी कोणहरुको योगफल कति हुन्छ ?

क) १८०° ख) १९०° ग) २७०° घ) ३६०°

१४ अर्धवृत्तको क्षेत्रफल निकाल्ने सूत्र के हो ?

क) $\frac{\pi r^2}{2}$ ख) πr^2 ग) $2\pi r$ घ) πr

१५. दिएको चित्रमा$\angle CHG$को क्रमागत भित्रीकोण कति हुन्छन?



क) ∠BGHख) ∠DHG ग) ∠AGHघ) ∠EGB

१६. दिएको त्रिभुजमा x को मान कति हुन्छ ?

क) ६०° ख) ७०° ग) ८०° घ) ९०°

१७. दिएको त्रिभुजमा y को मान कति हुन्छ ?

क) ३०° ख) १४° ग) १७° घ) १८°

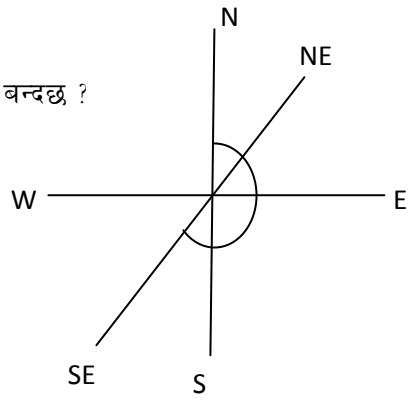
१८. दिएको चित्रमाx को मानकति हुन्छ ?

क) 5 cm ख) 6cm ग) 7cm घ) 8cm

१९ वृत्तको परिधी निकाल्ने सूत्र लेख्नुहोस् ।

क) $2\pi r$ ख) πr^2 ग) $\frac{\pi r 2}{2}$ घ) πr

२०. दिएको चित्रमा SW सम्मको कम्पास दिशा स्थितिमा कति डिग्रीको कोण बन्दछ ?



क) ६०° ख) ४५° ग) ९०° घ) १८०°

APPENDIX-B

Pre –test Scores of Students of Experimental and Control Group Out of 20 Full Marks.

Students	Experimental Group(X_1)	Students	Control Group(X_2)
1	16	1	15
2	13	2	14
3	12	3	11
4	11	4	12
5	12	5	11
6	10	6	11
7	9	7	10
8	8	8	8
9	8	9	7
10	7	10	8
11	7	11	6
12	6	12	7
13	6	13	6
14	5	14	5
15	4	15	5
16	5	16	4
17	4	17	5
18	4	18	3
19	3	19	4
20	3	20	3
21	3	21	3
22	3	22	3
23	3	23	3
24	3	24	2
25	2	25	2
N=25	Mean = 6.68 Variance = 13.62 Standard Deviation= 3.69	N=25	Mean = 6.72 Variance = 12.88 Standard Deviation= 3.58

Value of t-test = -0.03

APPENDIX-C

Post –test Scores of Students of Experimental and Control Group out of 20 Full Marks.

Students	Experimental Group(X_1)	Students	Control Group(X_2)
1	20	1	16
2	20	2	15
3	12	3	15
4	16	4	12
5	9	5	14
6	8	6	8
7	7	7	6
8	6	8	6
9	12	9	7
10	14	10	12
11	9	11	10
12	13	12	14
13	14	13	8
14	18	14	12
15	7	15	10
16	12	16	12
17	18	17	6
18	16	18	11
19	12	19	14
20	7	20	10
21	10	21	13
22	13	22	12
23	15	23	7
24	18	24	6
25	5	25	16
N=25	Mean= 10.92 Variance= 21.47 Standard Deviation= 4.63	N=25	Mean= 10.88 Variance= 10.81 Standard Deviation= 3.28

Value of t-test =3.74

Appendix – D

Reliability of the Test Item Using by Split Half Method.

Students	Odd Items.				Even Items.				Total Sum
	Very short	short	long	Total	Very short	short	long	Total	
1	2	4	6	12	2	4	8	14	26
2	2	5	8	15	2	4	7	13	28
3	1	6	7	14	2	2	8	12	26
4	1	6	2	9	0	4	8	12	22
5	2	2	6	10	1	4	6	11	21
6	2	4	2	8	2	4	5	11	19
7	2	4	3	9	2	3	5	10	19
8	1	3	4	8	0	3	3	6	14
9	0	6	1	7	1	4	1	6	13
10	1	3	0	4	0	3	2	5	9

(Split Half Reliability of the Test)

Students	Odd(X)	Even(Y)	XY	X^2	Y^2
1	12	14	168	144	196
2	15	13	195	225	169
3	14	12	168	196	144
4	9	12	108	81	144
5	10	11	110	100	121
6	8	11	88	64	121
7	9	10	90	81	100
8	8	6	48	64	36
9	7	6	42	49	36
10	4	5	45	16	25
N=10	$\sum x=96$	$\sum y=100$	$\sum xy=1062$	$\sum x^2=1050$	$\sum y^2=1092$

Reliability of split half test, r_{xy}= $\frac{N\sum XY-\sum X.\sum Y}{\sqrt{N\sum Y^2-(\sum Y)^2}.\sqrt{N\sum X^2-(\sum X)^2}}$

$$=\frac{10\times1062-96\times100}{\sqrt{10\times1092-(100)^2}.\sqrt{10\times1050-(96)^2}}$$

$$=0.93$$

Therefore, reliability of whole test (r_n) $=\frac{2r_{xy}}{1+r_{xy}}$, $=\frac{2\times0.93}{1+0.93}$

$$=0.96$$

APPENDIX-E

Result of Mathematics Motivation Score in Experimental and Control Group

Students.	Scores obtained in experimental group	Students.	Scores obtained in control group
1	28	1	20
2	24	2	21
3	17	3	10
4	15	4	18
5	26	5	25
6	24	6	22
7	25	7	26
8	27	8	24
9	20	9	15
10	18	10	18
11	20	11	17
12	18	12	16
13	14	13	12
14	22	14	21
15	26	15	25
16	26	16	26
17	20	17	12
18	22	18	21
19	21	19	14
20	26	20	25
21	15	21	10
22	9	22	11
23	7	23	8
24	12	24	11
25	10	25	10
N=25	$\bar{X}_1$=19.68, S_1^2 =34.76, S_1=5.89	N=25	$\bar{X}_2$ =17.52, S_2^2= 31.76 S_2 =5.63

APPENDIX-F

Teaching Episodes in Teaching Geometry by Using Materials.

Teaching Episode No.1

Subject: Com. Mathematics **Date: 2074/02/07**

Unit: Triangle **Time: 45 Mins.**

Topic: Types of Triangle on the Basis of Side **Class: Eight**

1. Specific objectives:

   After completion of this topic students will be able to

   - Classify the types of triangle on the basis of sides.

1 Teaching materials:

Geoboard

2 Teaching learning activities:

During the class period the teacher will do the following activities.

- At first we define the concept of triangle and its types on the basis of sides. For example: if all sides of triangle are equal, then the triangle is called equilateral of triangle, if any two sides of triangle are equal, then the triangle is called isosceles triangle and if all sides are different, then the triangle is called scalene triangle.
- By using geoboard, we show all types of triangle and one by one doing by students also.
- At last asking the concept and types of triangle to the students alternatively.

4. Evaluation:

- What is equilateral triangle?
- What is isosceles triangle?
- What is scalene triangle?

5. Homework:

Make 3/3 figures of each type of triangle?

Teaching Episode No:2

Sub: Com. Mathematics **Date: 2074/02/08**

Unit: Line and Angles **Time: 45 Mins**

Topic: Angles **Class: Eight**

1. Specific objectives:

   After completion of this topic students will able to

   Make different types of angles (30^0, 45^0, 60^0, 90^0, and 180^0)

2. Teaching materials:

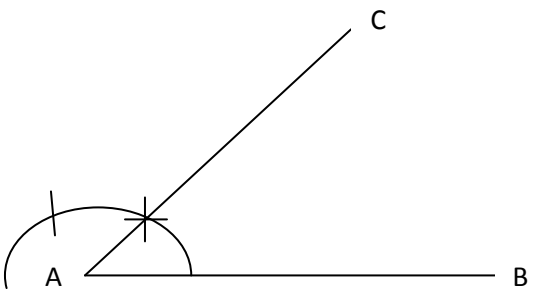
   Scale, Compass, pencil etc.

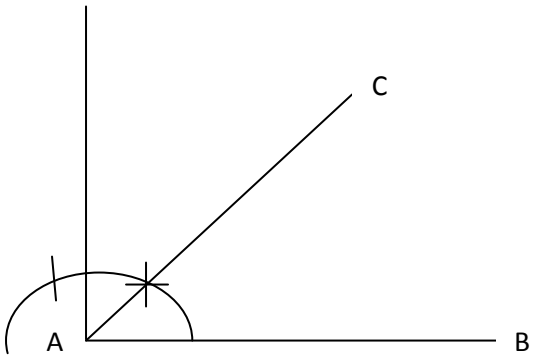
3. Teaching learning activities:

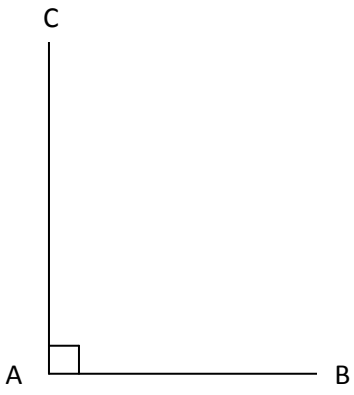
   At first we do all types of angles by using geometric tools on white board.

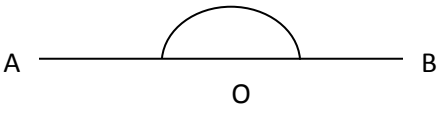
   For example:

   a)









   Similarly, one by another we practice them alternatively.

4. Evaluation:

   Draw the angles 30^0,60^0 and 90^0 on your copy.

5. Homework:

   Draw the following angles:

   a) 30^0 b) 45^0 c) 180^0 d) 90^0 e) 270^0

Teaching Episode No: 3

Subject: Com. Mathematics **Date: 2074/02/09**

Unit: Congruence **Time: 45 Mins**

Topic: Congruence of Triangles **Class: Eight**

1. Specific objectives:

   After completion of this topic students will able to

   - Compare and congruent to triangles (2 Figures)

2. Teaching materials:

   - Geoboard
   - Charts with congruent triangle.

3. Teaching learning activities:

During the class period the teacher will do the following activities.

- At first we teach the concept of congruent of any figures by telling some examples. For e.g. pair of eyes, pair of ears, pages of book etc.
- By showing chars of congruent triangle we explain one – by- one of congruent triangle.
- By using geoboard we compare and congruent of two triangle and one-by-one doing by students also.

4. Evaluation:

   - Tell any two examples of congruent figures.
   - How many sides and angles are equal in congruent triangle?

5. Homework: Complete exercise 2.1 (a), (b), (c), and (d).

Teaching Episode No: 4

Subject: Com. Mathematics **Date: 2074/02/10**

Unit: Similarity **Time: 45 Mins**

Topic: Similarity of Triangle **Class: Eight**

1. Specific objectives:

   After completion of this topic students will be able to

   - Compare and similar to triangles.

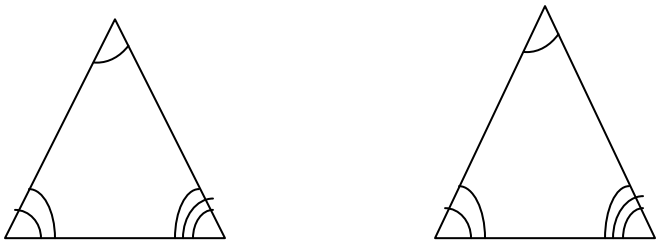
2. Teaching materials:

   - Geoboard

3. Teaching learning activities:

At first we give the concepts of similar by giving some examples. For e.g. man and his photo.

By using geoboard we show the concepts of similar of triangles.



At last we make them figures of pair of triangles on their copies and similar them.

4. Evaluation:

   - Tell any two examples of similarity.
   - Make similar triangle on your copy.

5. Homework:

   - Make any four different similar triangle on your copy

Teaching Episode No: 5

Subject: Com. Mathematics **Date: 2074/02/11**

Unit: Circle **Time: 45 Mins**

Topic: Area and Perimeter of Circle. **Class: Eight**

1. Specific objectives:

After completion of this topic students will be able to

- Find the area and perimeter of circle.

2. Teaching materials:

Charts including different parts of circle.

3. Teaching learning activities:

At first we show the chart of circle. From this chart we explain the concept of radius, diameter, circumference, center, semi-Circle etc. End of this concepts we write formulae of circle related to area and perimeter. By using the formulae of circle related to area and perimeter, we do any two question.

For e g. If r = 7cm, find the area and perimeter of circle.

So, $A = \pi r^2$ and $P = 2\pi r$

$= \frac{22}{7} \times 7 \times 7$ $= 2 \times \frac{22}{7} \times 7$

$= 154\text{cm}^2$ $= 44\text{cm}^2$

At last we give some related problem to the students and practice them.

4. Evaluation:

a) Write the formulae of finding area and perimeter of circle.

b) What is value of π?

5. Homework:

a) Complete the exercise 3.1

1, 2, 3, and 4 all.

APPENDIX-G

Interview Guide Line

- Ways to motivate the students.
- Feeling the student's use of instructional materials.
- Student's reflection toward instructional materials.
- Teacher reflection toward instructional materials.

APPENDIX-H

Statistical Formula used in Data Collection and Analysis Procedure

SN	Subject	Notation	Formula
1	Mean	$\bar{X}$	$\frac{\sum fX}{N}$, Where f if frequency and X is the random variable.
2	Variance	S^2	$\frac{\sum f(x-\bar{x})^2}{N}$
3	Standard deviation	S	$\sqrt{\frac{\sum f(x-\bar{x})^2}{N}}$
4	Parsons's correlation coefficient	r_{xy}	$\frac{N\sum XY-\sum X.\sum Y}{\sqrt{N\sum Y^2-(\sum Y)^2}.\sqrt{N\sum X^2-(\sum X)^2}}$ Where, X and Y are the paired scores and N is number of paired scores.
5	Spearman Brown	r_{tt}	$\frac{2r_{xy}}{1+r_{xy}}$. Wherer_{xy} is the Pearson's correlation coefficient?
6	T- test	T	$\frac{\overline{X_1}-\overline{X_2}}{\sqrt{\frac{{S_1}^2}{n_1}+\frac{{S_2}^2}{n_2}}}$, Where$\overline{X_1}$ and$\overline{X_2}$ are mean of experimental and control groups respectively. ${s_1}^2$And${s_2}^2$ are variance of experimental and control group respectively. Similarly n_1 andn_2 are number of student lies on experimental and control group respectively.
7	Degree of freedom	F	N_1+N_2-2