EFFECTIVENESS OF INDUCTIVE METHOD IN TEACHING GEOMETRY AT SECONDARY LEVEL

A

THESIS

BY

UMESH PRASAD ACHARYA

FOR THE PARTIAL FULFILLMENT OF THE REQUIREMENTS

FOR THE DEGREE OF MASTER OF EDUCATION

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CENTRAL DEPT. OF EDUCATION

Letter of Certificate

This is to certify that **Mr. Umesh Prasad Acharya**, a student of academic year 2068/069 with campus Roll No. 292, Exam Roll No. 281896, Thesis number 1047, and T.U. Regd. No. 9-2-240-412-2007 has completed his thesis under my supervision during the period prescribed by the rules and regulations of Tribhuvan University, Nepal. The thesis entitled **"Effectiveness of Inductive Method in Teaching Geometry at Secondary Level"** has been prepared based on the results of his investigation. I, hereby, recommend and forward that his thesis be submitted for evaluation as the partial requirements to for award the degree of Master of mathematics Education.

…….. ……

(Assoc. Prof. Dr. Bed Raj Acharya) (Mr. Abatar Subedi)

Supervisor For Head

Date:……..

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Letter of Approval

A

Thesis

By

Umesh Prasad Acharya

Entitled

"Effectiveness of Inductive Method In Teaching Geometry

At Secondary Level"

has been approved for partial fulfillment of requirement for Degree of Master of Mathematics Education.

Committee for Viva-Voce	**Signature**
1. Mr. Abatar Subedi (For Head)	…….
2. Prof. Dr. Hari Prasad Upadhyay (Member)	…….
3. Assoc. Prof. Dr. Bed Raj Acharya (Member)	…….

Date:……

DEDICATION

This study is

Dedicated to My Affectionate Parents

Who Gave Me Grandeur Opportunity to

Step in This Earth

And

All My Respected Teachers

Who Have Contribution to

Arrive Me in This Position.

ACKNOWLEDGEMENT

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Finally, my thanks goes to my wife Mrs. Jyoti Paudel and brother Mr. Dinesh Acharya for editing language of this research report and his technical support. Also, I would like to thanks to my colleagues, who helped me directly and indirectly. …..... ……

Umesh Prasad Acharya

ABSTRACT

Mathematics takes important place and usages in different ways in human life. So, it is necessary to learn and teach in systematic way at schools level mathematics. Among various teaching methods here, the present study concentrated on measuring the effectiveness of inductive method in teaching geometry at secondary level. This study was based on the following objectives are, (i) To explore the effectiveness of inductive methods in teaching geometry at secondary level students, (ii) To compare the achievement of the students in teaching geometry taught by inductive method with achievement of the students taught by deductive method.

For the data collection, one government school were selected purposively and pretest, posttest, non-equivalent group experimental design was used to conduct this study. 18 students were selected in group 'A' as a experimental group and 18 students were selected in group 'B' as a control group according as their pretest result. Experimental and control groups were assigned by tossing a coin. Two groups were taught same topic "Geometry" Experimental group was taught by using inductive method and control group was taught by deductive method of teaching. After completing the experiment both groups were administered a post- mathematics achievement test.

Teaching modules and achievement test were the main intervention instrument and tools respectively for the study and mean, standard deviation; variance and t- test (at 0.05 level of significant) were used as statistical tools for the study. After analyzing the obtained data, it was concluded that result of the study. Inductive method of teaching had better achievement than that of the Deductive method of teaching.

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LIST OF SYMBOLS

P	-	Item Difficulty Level
D	-	Discrimination Index
S	-	Standard Deviation
S^2	-	Variance
N	-	Number of Students
H_0:	-	Null Hypothesis
H_1:	-	Alternative Hypothesis
X	-	Independent Variable
√	-	Tick on Correct Answer
X□	-	Mean
%	-	Percentage
∑	-	Summation

Chapter-I

INTRODUCTION

Background of the Study

The word "mathematics" is derived from an ancient Greek word "Manthenein" which means to learn. So, mathematics is the process of learning and it is an expression of human mind, concerned chiefly with idea. Process and reasoning. Its elements are logic, intuition, analysis, construction, generality and individuality. It is a way of organizing a logical proof. It can be used to find out whether it is probably right time. As a way of reasoning gives us insight into the power of human mind and becomes a challenge to intellectual curiosity. It is a language in which we use ideograms and symbols instead of words. So, Mathematics is an organized structure of knowledge in which each proposition is deducted logically from previously proved prepositions or assumptions it compares skills, techniques and arts by which men conveys ideas and concepts of facts.

Mathematics results from the discovery from formulation, systematic development and the application of pattern of inductive and deductive thinking. Mathematics is the central part of curriculum not only in our school but also in the entire world. Every society has observed Mathematics as a basic need of human civilization. New discoveries in Mathematics and Mathematics education are still in continuing action. Today the other discipline such as science, engineering medicines and technology and more are handicapped without mathematics and the world cannot run smoothly without it. Thus, the importance of mathematics is realized due to its role for the development of science and technology in one hand and on the other it has become the gatekeeper in the life of the student for career choice in further study. Those students who have not good performance fails to get admission in socially value field of education such as

engineering , medicine, economics, computer, related field and so on. So, it is the concern of both stakeholder and the teacher to make the teaching of mathematics better for getting the better scores in mathematics. Historically the importance of mathematics is realized both for the needs of everyday life and academic study.

The method is important for mathematics teachers and learners while teaching and learning in school education. So the teaching method is essential in formal schools of the world .Mathematics education is the dynamics side and individual part of human life. It should be a means for the cultivation of the self and the whole. Emphasis on the curriculum must shift from the world of the person. The implications for teaching education, the essentialist committee for the advancement of American education (1983): states, "The function of teaching is to bring the essential portion of cultural heritages and the uniformed child together by transmitting to the students and instilling into him to essential portion of the accumulated heritage." So, education and human life is the two sides of a coin. Without mathematics education the human life is meaningless.

In Nepal, studies have shown that mathematics education was largely managed and imparted through traditional lecture approach ,rote memorization , and cramming. Many students have the habit of only memorizing factual information from their textbook without thinking "why?" worst of all , the student merely copy what the teachers have written on the blackboard and then memorize only that information while even neglecting their textbooks. It is not only painful for the students to engage in such rote memory; it also takes the long period time to do this work.

Nowadays, various methods and techniques of teaching have been developed by the pedagogies. Now, traditional methods of teaching are criticized and replaced by newer methods

through researchers. Teachers need to have exposure of the developed methods to bring into use in classroom teaching. Traditional methods are taken as expository method. This method assumes that learning is possible through the activities of teacher's explanation and students' memorization. At present, this process of learning is claimed not as the meaningful learning.

Mathematics instruction today must be broader and more inclusive than in the past. Also meet the increasing demands made on the mathematical competence of students. The mathematics instructions most do more than develop the basic skills and techniques, although the goals of mathematics will include these skills and techniques. In other words, it must develop more vocabulary facts and principles, more than the ability to analyze a problem or a situation more than an understanding of the logical structure of mathematics.

Mathematics has been originated in certain areas of the ancient orient primarily as a practical science to assist in agricultural and engineering pursuits, but with the development of other mathematical fields, the development of geometry is notable and prominent in the seventeenth century as science of dynamics, fields of pure geometry, modern analytic geometry, modern number theory and theory of probability. Furthermore Eves stated that geometry is the study of properties of shapes. The shape of an object is something visible and everyone begins to acquire geometrical knowledge and understanding from childhood. Approach of study of geometry differs by different civilizations. In pre-Hellenic time some geometrical theorems would probably be considered as obvious and if anyone has had doubt, that person would have to convince himself by performing simple experiments. Now, truth of any geometrical propositions is derived through deduction. Thales gave the first non-experimental proofs of geometrical theorems with logical thinking, and Euclid developed the logically acceptable sets of postulations, which nowadays called "Axioms", postulate is any statement involving primitive

terms which is accepted as true. The sets of postulates and axioms along with some rules of logical reasoning established the procedure of the deductive proof of geometrical theorems.

In this world of today nobody can live without mathematics even for a single day. Mathematics is intimately involved in every moment of everyone's life mathematics originated along with the origin of human civilization. In the creation of the modern science and technology there is a great role of mathematics. Without mathematics developments in the fields of science and technology are not possible mathematics like language is a basic tool of communication involves the fluent use of mathematics concepts. Thus, it is quite natural that mathematics be given a very important place second to language in school education.

"Mathematics "is a gate and key of science. Neglect of mathematics word is injury to all knowledge. Since he who is ignorant of it cannot know the other sciences or a thing of the world and what is worse man who are thus ignorance and so do not seek a remedy.(Eves,1990)

The genesis of inductive and deductive method are credited to British philosopher Francis Bacon (1562-1626AD) and the Greek philosopher Aristotle (322-384Bc) respectively. Aristotle and his followers studied patterns of correct and incorrect reasoning.

The concept of inductive, deductive method explained on mathematics Dictionary (1988) is as follows:-Inductive methods lead from concrete to abstract, particulars to generals and examples to formula. It is the method of constructing formula with help of sufficient number of examples. It is based on induction which means providing a universal truth by showing that if it is true for all such cases.

A formula or generalization is thus, arrived at through a convincing process of reasoning and solving a problems. After a number of concrete cases have been understood, student successfully attempts the generalization.

Deductive method is different from inductive method. It proceeds from order of inductive method. Here, the learner proceeds from general to particular, abstract to concrete and formula to example. A pre-constructed formula is told to a student and they are asked to solve the relevant problems with the help of that formula. The formula is accepted by the learners as a pre-established truth.

Mathematics plays a significant role at all levels of the schools education in Nepal. The history of secondary school mathematics in Nepal was started with durbar school, which was the first english school established in 1910 B.S. (1853 A.D.) affiliated with Calcutta university, India. School leaving certificate course of study for SLC Examination was developed in Nepal for the first time in 1934 A.D. This course of study included mathematics as a compulsory subject and there was a optional subject mathematics in the secondary school curriculum each carrying hundred marks.

Now a day, mathematics has been used in every activities of human life, science and technology. Mathematical understanding is essential for effective living in the society. The needs of our society is constantly changing. In order to keep pace with this change, mathematics education should go along with that change. Mathematics education to fulfill the needs of an advanced and advancing community, must be under continual scrutinizing and undergo constant change and it is the responsibility of all mathematics, working in university, school or industry, to concern themselves with the problem of keeping mathematical education vital and up to date (NCTM, 1992).

Various steps have been taken by the government to bring about effectiveness in the implementation of the curriculum. A host of projects and bodies such as Basic and Primary Education project and secondary Education Development Project are conducting programs such

as in-service training and holding workshops on preparing teaching materials etc. to develop the teaching skills of mathematics teachers. Through such activities and effort teachers are encouraged and educated to make teaching more students centered . This efforts might have changed teacher teaching methods and have provided insight and skills to identify what mathematics are suitable to the students.

Explanation is found regarding the development of geometry in the field of mathematics. Some perfect to claim the logic, the prime things. Other say the real natural world's phenomena geared the motion in the development of this discipline.

Butler and wren (1941) stated that primitive people obtained their first knowledge of geometry from natural objects and later on from arts as well. The needs that arose to understand and carry on further the legacy of art, architecture, surveying, measurement etc. provided the stimuli, for the development of science of geometry, symmetry, congruence, and similarity came into existence and provided a firm foundation for the science of geometry.

Furthermore, butler and wren (1941) have suggested that student of junior high school had to learn geometrical concept. Therefore, junior high school has to systematize geometric information and extend it to some of the broader and more general aspect of the geometry of everyday life. To aid the pupil in becoming familiar with the basic geometrical concepts and understanding the fundamental techniques, such as the use of the scale, protractor, compasses, and the techniques of measurement and construction, to acquaint the pupil with the characteristics of good geometrical notion; to bridge the gap from the largely manipulative types of geometric experiences to the more formal logical processes of demonstrative geometry. Such geometry has been called "intuitive" but it is rather a geometry is genius which is characterized by intuition, experiment and an informal approach to the more formal logical processes of

demonstrative geometry. To omit any one of these three aspects (intuition, experiment and in informal approach) give an imperfect description of provinence and functions of the geometry of the junior high school" (Bell ,H.F. 1978).

Mathematics has been taught as a compulsory subject at all levels of school system in Nepal besides compulsory mathematics optional mathematics is also offered to willing and worthy students. In both subject areas, geometry is taught separately as important area and has an integral part of the whole school mathematics curriculum. Thus, geometry is considered as an important component of school mathematics programme. There is a vital role of teacher to show all these importance of geometry to the students in their teaching.

Though, the importance has been given to the geometry in the school curriculum, there is no considerable attainment that has been expected. There are major problems and issue in the teaching geometry rather than other areas of mathematics. In this connection, Shrestha (1991) claimed that school level students did better performance in algebra and arithmetic rather than geometry. This implies that geometry has become a difficult subject for the students.

The inductive method is deeply entrenched in mathematics education. Traditionally mathematics courses were taught deductively, with the teacher teaching the students the facts and theory, then moving to textbook exercises and finally application. Using the inductive to deductive method, the teacher presents the students with a specific challenge or problem that occurred in real life situation, such as an experiment that needs to be interpreted, or a real-world problem that needs to be solved. The students must then use their base-knowledge to investigate, test, analyze and come to their own conclusion or solution in the form of generalization. The inductive to deductive method, which is commonly interpreted in school as the scientific method is widely used as a guide for observation and inquiry based learning.

Statement of the Problem

Mathematic is the one of the most important subject in twenty first century. It has close relationship with many other branch of education . Most of the people see mathematics as a difficult subject and they blame mathematics that causes pass rate lower. Besides these, there are many reasons such as mathematics teaching focus on product. Similarly students focus on rote learning than understanding. Even a trained teacher cannot implement the appropriate methods, techniques and procedures that have learning during period. There are no sufficient teaching materials and appropriate teaching methods. Students have the habit of reading mathematics like other subjects and do not practice mathematics problem sufficiently. It is the problem of the people who worked in the field of mathematics. The experimental inductive methods are much more suitable for student at secondary school because of their age. The objective of this paper to describe the inductive method as well as the process and result of research whose aim was to verify the effectivity of the non-traditional inductive methods for mathematical education at secondary level. The researcher intended to study on effectiveness of using inductive to deductive and deductive methods in teaching geometry at secondary level students.

Objectives of the Study

The objectives of the study are:

- To compare the achievement of the students in teaching geometry taught by inductive method with achievement of the students taught by deductive method.

- To explore the effectiveness of inductive and deductive methods in teaching geometry at secondary level students.

Research Questions

This study focused to give answer to the following research questions **:**

- Does the inductive method affect the achievement of the students in teaching geometry compared to deductive?
- Is the inductive method more appropriate than the deductive method at secondary level of teaching mathematics?

Significance of the Study

Mathematics is one of the most important subjects in twenty first century. But many people see mathematics as a difficult subject and many students failed in mathematics in each grade. The main problem or the challenging question to mathematics education is how a teacher can teach and students learn mathematics effectively. The teacher can't keep contact with the students individually since there are large and crowded classes in the context of Nepalese. The result of this study will help in the following way:

- This study would be helpful to math teachers, students, text book writer's researchers and educational planners etc. To understanding the principles of mathematics.
- This study would suggest the mathematics teacher to adopt the effective teaching method.
- It would help for teacher, mathematics educators, curriculum planner etc, to follow inductive method and skills in their field.

Hypothesis of the Study

Research Hypothesis

There is significant difference between the mean achievement of class IX students taught by using inductive method and deductive method.

Statistical Hypothesis

Ho: $\mu_1 = \mu_2$ (Null Hypothesis)

H_1 : $\mu_1 \neq \mu_2$ (Alternative Hypothesis)

Where μ_1 and μ_2 are the parametric means of the achievements of students using the inductive method and deductive method on the topic "geometry".

Delimitation of the study

The study was limited in the following aspects:

- The study was limited in a sample of secondary level students of Nuwakot District.
- The study was based on experimental and control group of the grade IX students.
- Only the government schools was included in this study.
- The study was covered only the geometry of the entire math's curriculum of grade IX.
- The study was concerned in only the method of teaching.
- The study was experiment of only three weeks duration.

Definitions of the Terms

Method

It refers to a planned way of doing something.

Achievement

Achievement in this study is defined in terms of scores obtained by the students on a mathematics test constructed by researcher.

Effectiveness

Effectiveness in this study is defined in terms of the magnitude of the score obtained by experimental and control group in the mathematics achievement test for cognitive effects. Similarly feeling of students and teachers perception are also effectiveness for non-cognitive effects.

Inductive Method

Inductive methods lead from concrete to abstract, particulars to generals and examples to formula. It is the method of constructing formula with the help of sufficient number of examples.

Deductive Method

Deductive methods lead from general to particular, abstract to concrete and formula to examples. A pre-constructed formula is told to a student and they are asked to solve the relevant problems with the help of that formula.

Public School

Public schools are those schools which receive the government grant for the salary of teacher and other purpose.

Secondary School

The school where classes runs from grade 1 to grade 10.

Experimental Group

The group that is taught by the researcher using inductive method of teaching is called "Experimental Group"

Control Group

The group that is taught by the researcher using the deductive method of the teaching is termed "control group".

Chapter-II

REVIEW OF RELATED LITERATURE

In this chapter different literature to effectiveness of the teaching methods are reviewed in order to know about their effectiveness. To conduct any research a researcher needs to review the related literatures so that a researcher gets ideas and guidelines for his/her research and finally draws conclusions form the research.

It is essential to review the related literature to compare the study which provides the strong knowledge about the related topic. Numbers of books research reports, paper and other booklet can be found that concerned with curriculum teaching materials, method and so on. The inductive to deductive and deductive method in teaching mathematics in secondary level. The researcher has reviewed some related literature as follows.

Empirical Review

It is a description of how the research was conducted, including who the participants were, the design of the study, what the participants did, and what measures were used. It provides a review of related research, and develops the hypothesis for the research. It is also important for another research to be able to replicate the study.

Amatya (1978) did a research entitled "A study of the effectiveness of teaching mathematics with and without the use of instructional materials" with the aims to find out whether instructional materials are helpful to develop the mathematical concepts and to measure the difference in concept development among students in the experimental and control group of grade third. He concluded that the performance of students taught with the use of instructional materials was significantly improved when compared with the performance of the students taught without the use of instructional materials.

Kattel (2009) did a research on "effectiveness of collaborating learning in mathematics at secondary level". With the aim to determine the effective approach in learning mathematics and he concluded that collaborative learning method is more effective than traditional method in teaching matrix at class nine. Collaborative learning method better motivates students to learn, helps students to understand and perform better in achievement test over traditional method in teaching learning matrix at class nine.

Katawal (2011) did a research on "effectiveness of inductive method in teaching menstruation at secondary level". He concluded that the inductive method can be more effective than the deductive method in teaching menstruation at the secondary level. From the result of the study concluded that consequently better result in achievement test over deductive method.

Bhusal (2000) did a research on "A study on the effectiveness of teaching geometry using discovery module and expository module of teaching in secondary". He concluded that from this study is the researcher found that mean achievement score of the students taught by discovery method was higher than the students taught by using expository method. In conclusion, this study reveals that the discovery method can be more teaching geometry at the secondary level

Lamsal (2004) did an experimental research on "A study on effectiveness of problem solving approach in teaching menstruation at secondary level mathematics of grade nine students" with the aim to compare the achievement of students taught by problem solving approach to the achievement of students taught by traditional approach. A post test equivalent group design was adopted to conduct the experiment in concept menstruation of grade nine for four weeks. Sample of 58 students (31 boys and 27 girls) were taken and the developed test consisting 30 items. Statistical tools are mean standard deviation and variances. Also T-test was

used and concluded that achievement of students taught by problem solving approach of teaching improved significantly better achievement than the students taught by traditional approach.

Piaget (1957) study on the "child development" he found at the age of eleven and twelve, the child begins to be capable of formal operations, or deductive reasoning from hypothesis. This does not mean that he is incapable of deductive reasoning before them. Concrete operations include deductive reasoning. For example, when child reason that 4+2=4+1+1=6, he is doing deductive reasoning. Opportunities for deductive reasoning should not be neglected in elementary grades. Of course, the deductive reasoning is this stage should be restricted to reasoning about a real object and relations that the child perceives.

Gautam (2005) did a study entitled "effectiveness of instructional materials in teaching menstruation at secondary level". With the aim to explore the effectiveness of instructional materials in teaching menstruation at secondary level mathematics and to compare the mathematics achievements of boy's and girl's in content menstruation. A pretest-posttest equivalent group design was adopted for purpose of the study. He concluded that the students of experimental group performed better than the students of control group. It was also found that the boys and girls of experimental group equally benefited in cognizing concept of menstruation when taught by using instructional materials.

Kunwar (1997) conducted " A study on the effectiveness of activity of the materials in teaching in lower secondary " class-VI". After the experiment, it was concluded that performance of Nepalese students in selected school class that utilizes visual aids in teaching geometry was better than the students taught without the use of visual aids in geometry, and the materials effect in the achievement of the students.

Karki (2010) did a research on " A study on the effectiveness of instructional materials in teaching geometry grade X" with the objective to find the effectiveness of instructional materials in teaching geometry at grade X. From the result of this study it can be concluded that the instructional materials help to understand the geometric concepts clear to the students rather than the traditional method of teaching. Therefore, use of instructional in teaching geometry is more effective than teaching without using instructional materials.

The above researchers were done the study about the different teaching methods and materials. Many of them, were done at the algebra, mathematics. Although, very few researcher were held to find the effectiveness of inductive method on geometry. So, researcher was intended to study about the effectiveness of inductive to deductive method on teaching geometry at secondary level in Nuwakot district.

Theoretical Review

The theoretical review provides some lens to view my research, which gives some insights to my research agenda. It gives a framework for my research and explores my way of finding in my research and guides me relying on formal theory (lama, 2014). I have used social constructivism as my theory of this study.

Social Constructivism

Social constructivism approach to learning is needed because new knowledge is constructed in the context of preexisting knowledge (Phillips, 1995) and every individual child has a unique perspective (Moschkovich 2007, as cited in Ferner 2013). The social constructivist approach emphasizes on learners preexisting knowledge and we construct new knowledge base on our prior knowledge. If we link learner's prior knowledge with mathematics, they can learn easily and quickly and they can construct new knowledge. Social constructivism helps students

to become a critical thinker, active participator, knowledge constructor and collaborative worker. Social constructivist approach respects learner's creativity and critical thinking. The social constructivist thesis is that mathematics is a social construction, a cultural product, fallible like any other branch of knowledge (Ernest, 1998).

According to the social constructivist, the nature of mathematics is fallible. It means we develop mathematical concept and knowledge and it is changeable. Mathematics is established by human culture and language. Social constructivism as a basic perspective on learning, knowledge as actively constructed through interaction with the world. These interactions are guided by the influence of society, culture, and history(Kincheloe, 2008 as cited in Ferner, 2013). Vygotsky believed that children actively construct their understanding through solving problems in their own way (Belbase, 2007). Therefore, I believe that teacher needs to give an opportunity to students to solve problems according to their own way and encourage them to construct new knowledge through social interaction with their environment. Social constructivism views knowledge as a cultural product. It proposes that knowledge is best borne from social interaction.

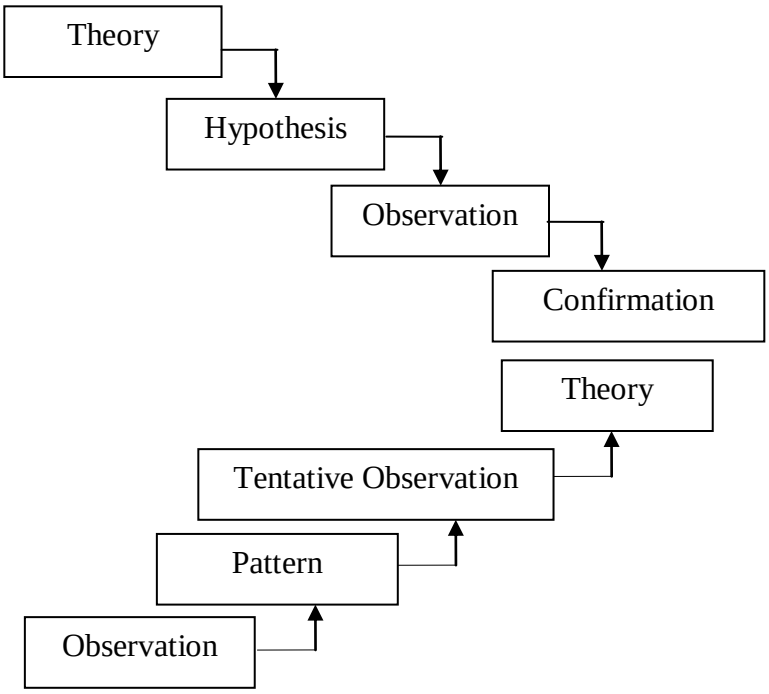
The viability of knowledge claims is judged based on the extent to which consensus is achieved from the various conceptions and experiences of members in a culture (Heylighen, 1995). Proponents of social constructivism argue that knowledge is constructed not only from personal experiences, but from social interaction with others (Jones, 1996). They argue, that knowledge is interwoven with culture and society (Ernest, 1992) and emphasizes social construction of reality.

I use social constructivism in terms of mathematics is around us and it is human construction. Therefore, we need to focus on student's prior knowledge, methods in teaching

mathematics in the classroom. We need to encourage student's to construct new knowledge base on their real world situation and experience. We need to link students with mathematics inductive method. I argue that social constructivist approach engages students in the classroom involve in group work and construct new knowledge through interaction with the world (school, home, environment and everyday life). Social constructivism links both the learning of mathematics and research in mathematics in an overall scheme in which knowledge travels either embodied in a person or in a text, and the processes of formation and warranting in the two contexts are parallel (Ernest, 1998).

Conceptual Framework

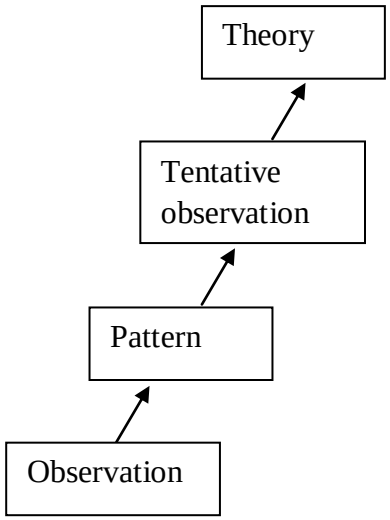
A conceptual understanding covers the main feature and their presumed relationship. Generally conceptual framework is representing in pictorial way. It helps to make explicit what we already know and think about the area and topic of the study. This study the effectiveness of inductive and deductive methods on students achievement in the teaching geometry at secondary level. Which is based on theoretical literature has derived the "effectiveness of teaching method" from the study of related literature above, the researcher made the framework for this study. This study had related to the following:



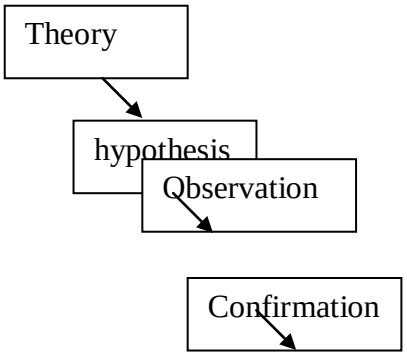
Source:- (Shaffer 1989,)

Inductive method

- Inductive reasoning works from specific Observation to broader generalization theory .
- Informally we some time call this a "bottom up " approach .
- Conclusion is likely based on premises.
- Involves a degree of uncertainty.



Deductive method



- Deductive reasoning work from the more specific .
- Sometime this is informally called a "top down approach " .
- Conclusion follows logically from premises (available factors).

From the above description when the researcher used inductive method, researcher included observation, pattern, tentative observation and confirmation theory respectively. And the researcher used deductive method which included theory, hypothesis, observation, and confirmation theory. Although from the above conceptual framework we elaborate the given as sub topics to measure the teaching skills from inductive and deductive method and above form was develop base on conceptual framework.

Chapter-III

METHOD AND PROCEDURES

Methodology is the most important part of the study. This chapter includes the procedure adopted in the study, which was carrying out to achieve the objectives of the study and to get answer of research question. It describe the design of the study, population and sample of the study, tools, calculation of reliability, item analysis, selection criteria, data collection procedure and data analysis procedure is described below:

Design of the Study

The pretest-posttest non equivalent group's experimental design was adopted for the purpose of this study. The pattern of the present study was as follows:

Table No. 1

Design of the Study

Groups	Pretest	Treatment	Posttest
Experimental Group	T_1	Inductive to deductive Method	T_2
Control Group	T_3	Deductive Method	T_4

Where,

T_1 / T_3 = Pretest given to the students of Experimental and Control group respectively.

T_2 / T_4 = Posttest given to the students of Experimental and Control group respectively.

This design was one of the most effective in the minimizing the threats to experimental validity. For this study, two groups were made homogeneous as nearly as possible to the basis of pretest result with establishment of two non equivalent groups experimental and control.

Experimental group was taught by using inductive method and control group was taught by using deductive method of teaching.

Population and Sample

The population of the study consists of the students who has taken compulsory mathematics in grade IX of public school at Nuwakot district is the population for this study. This study was experimental study and carried out in one school namely Shree Samundra higher secondary School, Samundradevi -7 Nuwakot. This school was selected purposively by the researcher because expectations and co-operation needed from the school. For the selection of the students first of all pre-achievement test was taken to the whole students who has taken compulsory mathematics in grade IX. There were altogether 36 students in as population. I had divided them into two sections. There were 18 students (7 boys and 11 girls) in section A, selected as experimental group and 18 students (8 boys and 10 girls) in section B, selected as control group. Then the pretest was administrated and students who attained in pretest were included of the selection of the sample students.

Variable Studied

In experimental design the effect of independent variable in a given condition was observed in dependent variable.

Independent Variable

In this study, the independent variable was method of teaching geometry in the classroom instruction in accordance with the characteristics of inductive to deductive method.

Dependent Variable

In this study, achievement scores of student in the test of mathematics and felling of students were considered as dependent variable.

Controlling the Variables in the Experiment

The experiment had done in shree samundra higher secondary school in Nuwakot, grade IX students were taught by using two different methods by researcher himself. In teaching process, researcher tried to control different factors from which the result may not different on another factors except on the case of teaching method..For this , both group students were taught same book, same topic and equal credit hours. On teaching both groups were used same teaching materials, given them same homework and class work. And selected members distinguish characteristics male or female, high or low intelligence and their age, social factors also considered where the making complete group.

The following non-experimental variables was tried to control or equate to each group in the following ways:

- Same subject matter were taught for both groups.
- The same test were used for both groups.
- Equal credit hours were given for both groups.
- The class was taken for both groups regularly.
- For both groups, the class was conducted (taught) by same researcher.

Tools of the Study

(i) Achievement Test

The researcher constructed an achievement test, which consisted of 50 objectives types of questions. They were based on the unit geometry (Triangles, Parallelogram, Area of triangle, Quadrilateral, Circle and similarity) of grade IX. The specification chart (table No:2)

Table No: 2

The specification chart for first Draft of the test

Area	S.N.	Unit/Level of objectives	Cognitive Level				Total
			Knowledge	Skill	Comprehension	Application	
Geometry	1	Triangle	7	5	1	1	14
	2	Parallelogram	3	7	1	1	12
	3	Area of triangle and quadrilateral	3	4	-	1	8
	4	Circle	4	3	2	1	10
	5	Similarity	2	2	1	1	6
Total			19	21	5	5	50
Percentage			38%	42%	10%	10%	100%

The test was prepared on the basis of four different skills (knowledge, skill, comprehension, application, based on inductive to deductive method) of prescribed curriculum and textbook of grade IX in geometry. In knowledge level question, students have to remember and recall term, symbols, formula, definitions, facts and principles. In skill level question, they have to apply knowledge and understanding of mathematics to unfamiliar situation and in this type of questions students need to find pre-requisite term and values. In comprehension level questions, students have to develop understanding of the terms, symbols, concepts and facts. In application based on solving by inductive to deductive methods, they have to apply their knowledge, understanding and skill which occurred in new situation. And among them, there

were asked 19 marks each carry 1 marks, in the knowledge level question, there were asked 21 marks each carry 1 marks in the skill level question. And there were asked 5 marks each carry 1 marks, in the comprehension level question, there were asked 5 marks each carry 1 marks in the application level questions.

Preparation and standardization of Intervention Instrument:-Module

To conduct an experiment the researcher developed a teaching module for the unit "Geometry" at Grade IX mathematics curriculum. This module developed on the basis of theoretical framework of the inductive method and deductive method. Detail information of the module is described in Appendix C to Appendix J.

(ii) Observation

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 students. Therefore, the variation in making of test paper was reduced. Eighteen students of morning shift were selected for inductive methods for experimental group and same as eighteen students of day shift were selected for deductive teaching methods for control groups.

(iii) Interview

After the end of experiment or post test, researcher had conducted an interview on 7th Ashwin 2073 B.S. For this purpose, researcher had selected six students three from each group i.e experimental and control group, one who had highest post score in their group, second who had average score and third who had lowest score. Finally at the end of an interview researcher had concluded that the view of students of experimental group was better than that of control group. Thus, it defines that the inductive method is better method of teaching than that of deductive method.

Item Analysis

The process of evaluating single test item to maintain the optimum difficult level and discriminating index etc, is item analysis. Item analysis indicates which items are very easy/difficult and which are not functioning properly. The prepared achievement test was administered in Shree Samundra higher secondary school in Nuwakot to 36 students of grade IX for item analysis. The test items were scored '1' for correct response and' 0' for the incorrect response. To analyze the scored item, the test paper in score was ordered from highest to lowest and was tabulated, The upper and lower groups were then separated. In order to analyze the items from 25% upper and 25% lower scores students, the researcher took 9 upper and 9 lower scores students out of 36.

Calculation of Reliability

To obtain an estimate of the reliability of the test papered, the scores of 20 students of the item analysis chart were identified by the letter A to T, in first column of the following table.(see Appendix K). In this table, second and third column were shown the scores on the odd and even items of fifty test items. The sum and differences between these twenty pairs of split half test scores has been shown in column fourth and fifth respectively. Since 25 percent of 20 students being near to 5, the five-highest sums and the five lowest sum in the fourth column were identified by the letter' H' and' L' respectively. The sum of the highest five is 208, of the lowest five is 90, so the difference between these sums equal to 118. The Squared difference is equal 13924. By a similar process the value 625 was obtained for the squared difference between the sum of five highest difference scores and the five lowest scores from fifth column. The quotient

of 625 divided by 13924 was subtracted from one to get the reliability coefficient, which was found to be 0.95511.

Validity of Tools

Validity is the degree to which a test measure what is supposed to measure. It is an evaluation of the sufficiency and appropriateness of the interpretation and assessment result. To demonstrate evidence of the content, the researcher first defined the universe of content that could be included in the test and then selected sample items. Items were selected base on their significance. Validity of the researcher activity, central variables cannot be controlled directly. Some of internal validity such as maturation, history, testing effect, time interval and statistical mortality were controlled through this design of the experimental and other external validity were controlled by interaction effect of pre testing, the artificiality of the experimental setting, the multiple treatment interference and so on. To improve the language, complexity and level of the test item, the researcher consulted experts and subject teachers.

Selection Criteria

The items having P-Level between 0.29 and 0.73 and D-index 0.19 and above were accepted otherwise the items were rejected. In the pre-test the items number 3,8,13,38,40,46 and 49 were cancelled and in post-test the items 3,9,13,18,20,22,28,30,34 and 35 were cancelled. The specification chart of the final test is given below:

Table No. 3

Specification Chart for Final Test

Area	S.N:	Unit/level of objectives	Cognitive Level				Total
			Knowledge	Skill	Comprehensive	Application	
Geometry	1	Triangles	6	4	1	1	12
	2	Parallelogram	4	2	-	2	8
	3	Area of triangle and quadrilateral	4	3	-	1	8
	4	Circle	3	2	-	1	6
	5	Similarity	1	3	1	1	6
	Total		18	14	2	6	40
Percentage			45%	35%	5%	15%	100%

Data Collection Procedure

In this study, the investigator identified two equivalent groups of students such that both groups were assumed to have homogeneity in variances with respect to abilities in mathematics education. For this purpose, the researcher visited sampled schools. The achievement test paper-I(pretest) was administrated to ninth grade students of school in the sample. The time was given to complete the test within 1 hour 30 minutes, which was estimated by multiplying 45 with the mean time taken by the students per item as speedily pilot test. In the examination, there were 18 students in section' A' and 18 students in section ' B' appeared for the same test. At the end of experiment, the standardized test was held in both groups. The answer sheets was collected and

scored the text paper. The researcher considered 18 students in section ' A' .The scores of these students were tabulated and then their mean and variance were calculated (see Appendix-O). Now, the researcher considered 18 students in section' B'. The scores of these students were tabulated and then their mean and variance were calculated.

The mean difference of two groups formed to check whether two groups were statistically homogeneous or not? Eighteen students were selected from each group of the school of Shree Samundra higher secondary school. Experimental 'A' and control ' B' groups were decided by tossing a coin. An achievement test paper-I (pretest) was administered before experimental teaching of the unit started. The test was composed of four distracted multiple choice questions and with the help of class teacher the researcher conducted the examination (see Appendix-B). After having both groups balanced in abilities in mathematics, both the experimental and control groups were taught by the investigator himself at their usual periods. The 21 days instructional phase was conducted as a part of the regular instructional activities of the schools. The researcher prepared lesson plan using inductive to deductive approach for teaching the experimental groups where as the control groups was taught deductively. Some lesson plans used in the class room is put in Appendix-C, D, E, F, G, H, I, and J. At the termination of the instructional period a post-test was administered to both the groups. Before administering the post-test, the students were instructed how to respond the test items. The duration of test was 1 hour and fifteen minutes. Answer to all the test items were scored on the basis of '1' for correct responses and '0' for incorrect responses. The scores on each item obtained by the students were calculated in items of statistical analysis. The reliability of the post-tests was found to be 0.96 (see split-half reliability calculation, Appendix-L.)

Data Analysis Procedure

Student's distribution (t) for non-independent sample was used for caring out comparison of pretest and posttest results. The t- test with two- tailed test at 0.05 level of significance value was used in the comparison of pretest result, where independent variable was not used as a treatment for experimental and control groups. Similarly, the t-test with two tailed at 0.05 level of significance value was used in the comparison of posttest results, where independent variable was used as a treatment to E-group against C-group. For the comparison of both the results. It was found that there were no significant differences between the variances of both groups. Therefore the researcher used t-test for correlated samples.

Chapter-IV

ANALYSIS AND INTERPRETATION OF DATA

In the preceding chapter, introduction of the study, review of related literature and methods of study are considered. This chapter has been designed for analysis of data and interpretation of results. The main objective of this study was to test the effectiveness of inductive to deductive and deductive methods on student's achievement in geometry at secondary level. The tools for gathering data was an achievement test on geometric content of grade IX. The data on achievement test scores have been analyzed under the following headings:

- Comparison of mean achievement scores of experimental and control groups on pretest.
- Comparison of mean achievement scores of experimental and control groups on posttest.

Analysis of Pretest Results

In Appendix-M the pretest raw scores of student of both groups are presented. The summary of statistical calculation for the experimental and control groups on the pretest is given in table-4 and figure-1 below:

Table No: 4

Comparison of Pre-test Result

Group	N	Mean	S.D.	Var.	t	Level of significance
E	18	30	5.705	32.555	1.26	Two tailed test at 0.05
C	18	29.67	5.878	34.555		

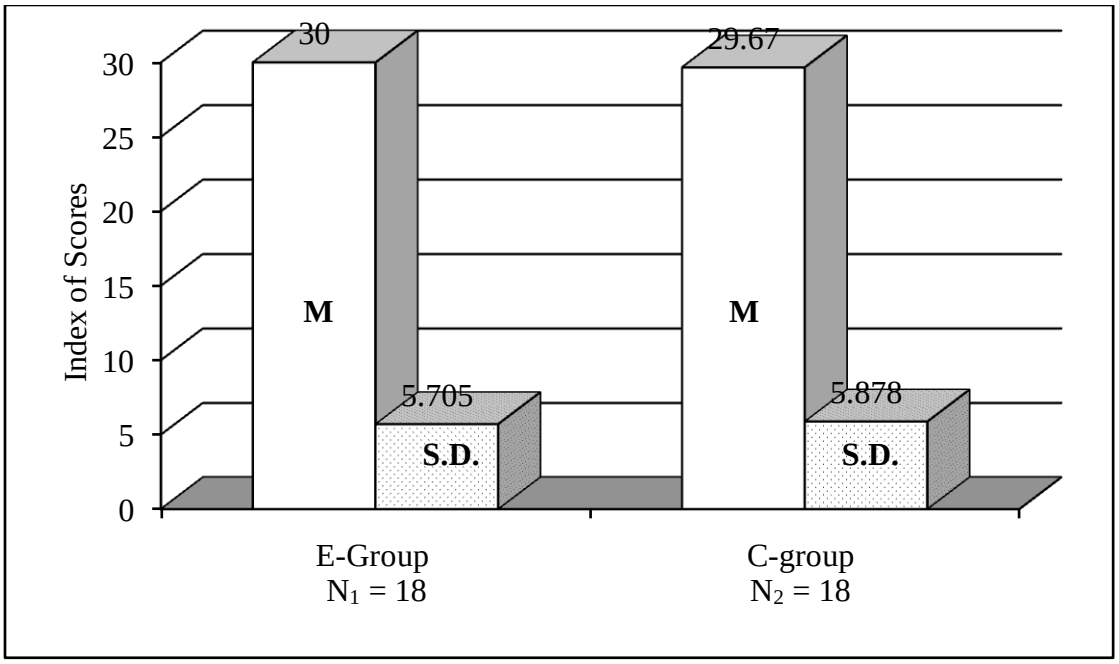
Since the calculated value of t (t = 1.26) was less the tabulated value ($t_{0.05, 17}$ = 2.110) (see Appendix -M) and the population variances of both groups were same .

Hence, the null hypothesis ($H_0 : H_1 = H_2$) of no difference in the mean of two groups (at

0.05 level) before the introduction of treatment variable was accepted. Thus, both groups were equivalent which was the basic condition that ought to be met in the experimental design for this study.

Figure 1

Mean Score and SD Score Distribution of Pretest Results



In this diagram, the mean and standard deviation scores obtained by the students of each group in the achievement test paper-I raw score have been shown. The diagram is more interesting for comparison. This shows that there is no difference in achievement scores of both group of students. So, this condition was very conduct to the experimental design for this study.

Analysis of Posttest Results

The posttest raw scores of students of experimental and control groups have been presented in Appendix-O, and the summary of statistical calculation for both groups on the post-test is presented in the table-5 and Figure-2 below:

Table No-5

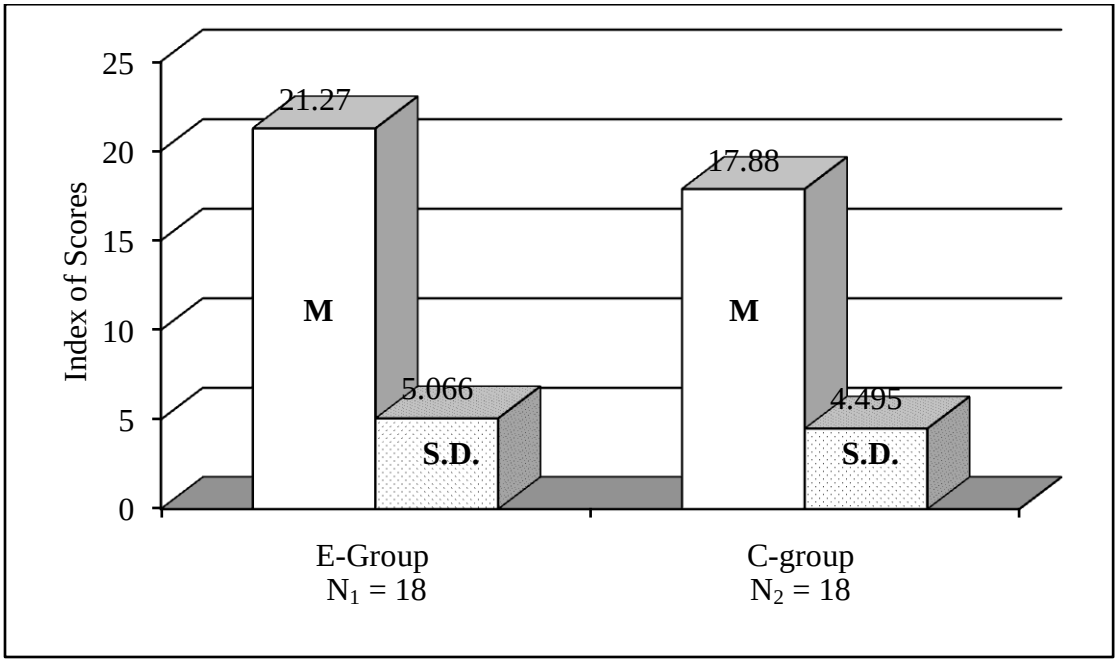
Comparison of Post-test Result

Group	N	Mean	SD	Var.	t	Level of significance
E	18	21.27	5.066	25.67	13.89	Two tailed test at 0.05
C	18	17.88	4.495	20.21		

The two population variances are homogeneous. Since the calculated value of t (t = 13.89) is higher than its tabulated value ($t_{0.05, 17} = 2.110$) (see Appendix-O). It was found that there is a significant difference between two means on the posttest was 3.39 (see Appendix - O). The evidence for the existence of result of significant difference between two means was due to the treatment X provided to experimental group against control group because both groups were statistically equivalent before the introduction of the treatment X. The mean of both groups were different, so the researcher used two tailed at 0.05 level of significance for t- test. Hence, the null hypothesis $H_0 : \mu_1 = \mu_2$ was rejected and alternate hypothesis $H_1 : \mu_1 \neq \mu_2$ was accepted. Thus, the researcher concluded that the students who were taught geometry (triangle, parallelogram, area of triangle and quadrilateral, circle, similarity) with the use of the inductive to deductive approach of teaching learning achieved higher than students who were taught with the use of deductive approach.

Figure II

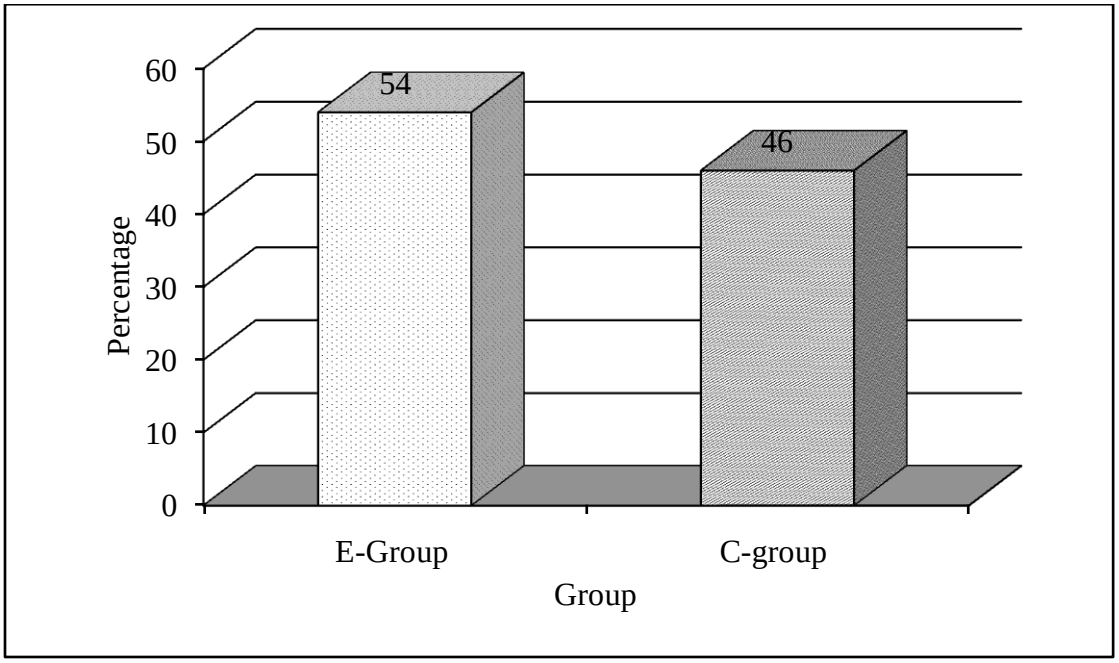
Mean Score and SD Score Distribution of Posttest Result



The mean and SD scores obtained by the students of experimental and control groups in the achievement test paper-II, raw score have been shown in figure-II. The column of experimental group of students is longer than that of control group students. This shows that there is a difference in achievement of mathematics between E-group and C-group of students. Since, the difference between the mean, standard deviation on the posttest was 3.39 and 0.571 respectively. Therefore, the figure-II indicates that the inductive to deductive approach of teaching mathematics is more effective than the deductive approach in secondary schools.

Figure III

Percentage Mean Score of E and C Groups.

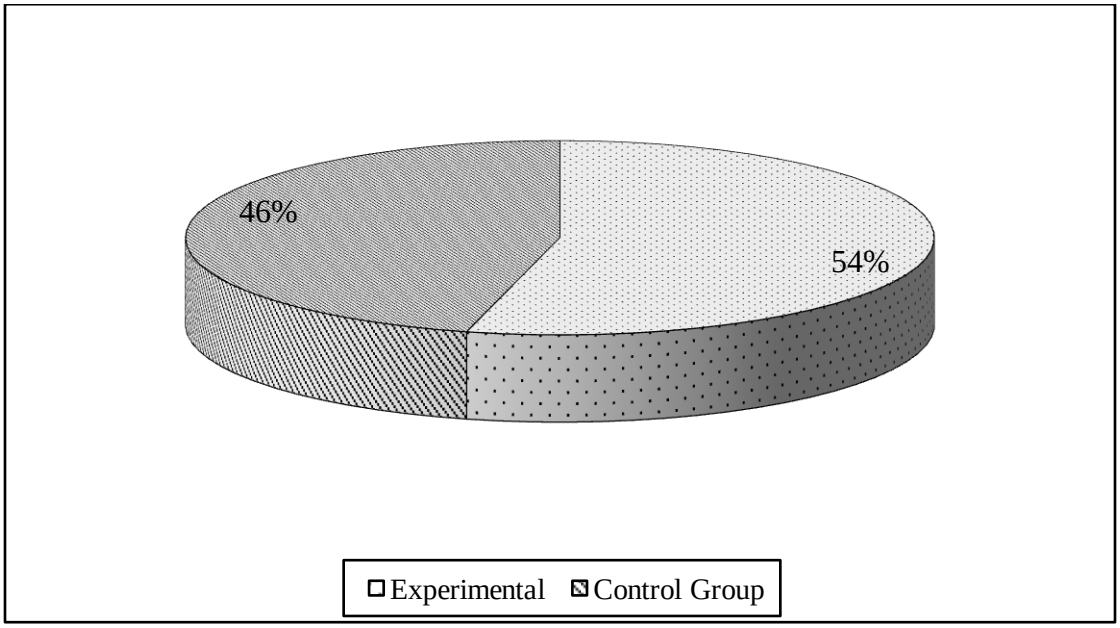


The above figure reveals that the percentage of mean score of E- group is fifty four percent and C-group is forty six percent. Therefore, percentage score of E-group is higher than C-group of students.

Similarly, the pie-chart clarifies the result of the scores in the study. It is more interesting for presenting the status of both groups. The mean achievement raw scores of E and C groups of students is shown in pie-chart below.

Figure IV

Mean achievement of E and C Groups



Thus, the pie-chart shows that the inductive to deductive approach of teaching mathematics is more effective than the deductive approach in Shree Samundra Higher Secondary Schools at Nuwakot district of Nepal.

Consequently, the inductive to deductive approach with materials of teaching mathematics was found to achieve higher achievement than deductive approach through lecture and without materials in secondary schools.

Analysis of non- Cognitive Effects

For the non-cognitive behavior of students, qualitative data were collected. For this, the researcher conducted workshop with the secondary mathematic teachers from the same resource center on 6th Ashwin 2073 B.S. and interview had taken on six students three from each group, one who had highest post test score in their groups, another who had average score and third who had lowest score on 7th Ashwin 2073 B.S. The interview had been conducted after post test.

Teacher's perception about inductive and deductive method

As researcher, I were conducted round table discussion with secondary mathematics teacher from the same resource center. The researcher had taught for both control and experimental groups. In the teacher perception, students taught by deductive method were passive. They could not gain perfect knowledge and unable to solve all the problems from test paper as well as text book. The students in control group seem to be monotonous and inactive. On the other hand, students taught by inductive method seemed to be very positive towards the uses of inductive method. Thus, the researcher concluded that inductive method is better than deductive method because inductive method is child centered and action oriented method. In inductive method, students learn by doing themselves and the knowledge they gain though this method remains permanent and tranferable. Thus every teacher should plan and teach students following the techniques of inductive method on the basis of the nature of lesson to be taught.

Feelings of student

On the completion of experimental stage, the researcher interact both control and experimental groups. The students of experimental group seem to be more satisfied with the new teaching method. They expressed their common attitude that thus new method made them easy to understand the geometry. They collectively paid very positive reaction for this new method of teaching. According to experimental group, they said to the teacher, "sirle kina hamilai pahilai aagaman bidhibata padhaunu nabhayeko? Yo bidhibata padhauda ta hamile dherai kura sikeun, aba ta geometry bata jasto prasna sodhepani hami garna sakchhaun". Thus the students strongly showed their positive response towards inductive method.

In the contrary to the experimental group, the students of control group seem to be very passive and they had expressed almost the same reaction that the deductive method has been applied is no more new, only the repetition of previous method. According to control group, they asked to teacher," sir hajurle naya kura ta kehi sikaunu vayena, yo ta khali pahileko jastai gari sikiyo. Hami ta geometry bata sabai prasna hal garna ajhai sakdainau". Thus they further said that it is monotonous method and repetition of the method they had known.

Chapter-V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

Summary of the Study

The present study intended to answer the question whether the performance of the students of secondary level taught by inductive method affects the mathematics achievement as compared to the performance of them taught by deductive method.

For the data collection of the study, the investigator developed and tested the reliability of two achievement test paper-I (pretest) and paper-II (posttest) before their administration. Both the tests consisted of objective multiple choice type items on the area of geometry from grade IX.

A pretest-posttest equivalent-groups design was adopted for the purpose of this study. Grade nine students of Shree Samundra Higher Secondary School were all students for sampling purpose. Two equivalent groups were established on the basis of the pre-test results. Both experimental and control groups were taught by the researcher himself on the same selected units. The instruction period was 18 days only. A posttest was administered to both the groups providing necessary instruction for usual period on the same units.

Along with other statistical measures, t-test was applied in order to ascertain the difference between two groups. The data was analyzed and interpreted statistically to find the conclusion.

Finding of the Study

On the basis of analysis and interpretation of the data obtained from the achievement test which has been described in chapter IV, the following findings were drawn:

- In the pre-test result mean achievement score of control group was almost equal to the mean achievement score of experimental group.
- In the post-test result, mean achievement score of control group was less than the mean achievement score of the control group. From this, it was found that inductive method of teaching had better result than that of deductive method of teaching at grade IX students.
- From the pre-test result, there is no significance between the achievement of secondary level students taught by using inductive method and deductive method and post-test result showed there is significant difference between the achievement of secondary level students by using inductive method and deductive method.
- The achievement of score of the experimental group who was taught by using inductive method performed better than the control group taught by deductive method of teaching geometry.
- Inductive method is found more effective in comparison to deductive method of teaching geometry in Grade IX.
- Inductive method helped students to comprehend the geometry that it is a suitable method to teach the students while dealing the geometry chapter.
- The students, in course of this research investigation, were found more comfortable and enjoying while the teacher was using the inductive method.
- The attitude of student towards the deductive method seemed monotonous and repetitive whereas their attitude towards inductive method was more appreciable.

- The teachers accustomed to the deductive teaching method even though got estranged to the inductive method at the beginning, later on reacted it as a more interesting, effective and fruitful method in the class room.
- The evaluation of the data collected in the research process proved that the experimental group in Grade IX inductive method was dramatically high in comparison to deductive method of teaching.

Conclusion of the Study

It is concluded that the mean achievement score of the students taught by inductive method was higher than the students taught by using deductive method. This study reveals that the inductive method can be more effective than the deductive method in teaching geometry at the secondary school level. From the result of this study it can be concluded that, the inductive method helps students to understand geometry and consequently perform better in achievement test over deductive method. Additionally the inductive method helps students to motivate and apply the known geometrical concepts in unfamiliar conditions.

Recommendations

On the basis of findings of the study some measures have been recommended for the improvement of teaching and learning mathematics at secondary level classes:

- Inductive to deductive method is recommended in teaching geometry at secondary level.
- Teachers should be encouraged to use inductive to deductive in giving samples.
- The teacher training institutes should focus their attention on inductive to deductive method for teaching mathematics in pedagogy course.
- Students should be encouraged to get involved in active participation in classroom activities.

- Curriculum designer, textbook writer should emphasize on inductive to deductive method. In preparation of mathematics textbook, emphasis should be given in inductive to deductive method and strategies throughout the school mathematics so that further generations will be equipped with skill to solve the problems of mathematics.

Suggestions for the further study

The following suggestions were made for the further study:

- Study on using different teaching and learning modules should be carried out so that these modules can be effective, used in classroom teaching and easiest way to introduce reforms in mathematics teaching.
- This study was confined only in Nuwakot district. Therefore, further study could be done in different districts and the result of study can be generalized.
- `It would be worthwhile to study the opinions and attitudes of teachers and students toward the use of appropriate technique with teaching materials.
- Similar studies may be carried out at each grade level of school in order to have wider view of inductive to deductive method in school level mathematics.

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APPENDIX-A

The Achievement Test (pre-test)

Time:-1:30 F.M.:-50

Class:-IX P.M.:-16

Attempt all the questions.

Tick (√) the best answers.

1. What is the sum of interior angles of a triangle?

   a) 90° b) 180°

   c) 270° d) 360°

2. What is the measure of each angle of an equilateral triangle?

   a) 30° b) 45°

   c) 60° d) 90°

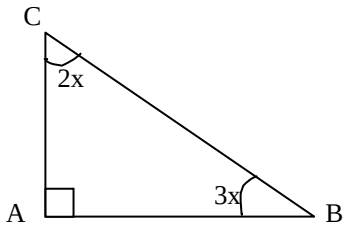
3. Which one of the following is the value of x?

   a) 18°

   b) 36°

   c) 45°

   d) 90°



4. The quadrilateral that has equal diagonals is ……..

   a) Rectangle b) Trapezium

   c) Square d) Both 'a' and 'c'

5. Sum of the interior angles of a parallelogram is ……..

   a) 90° b) 180°

   c) 270° d) 360°

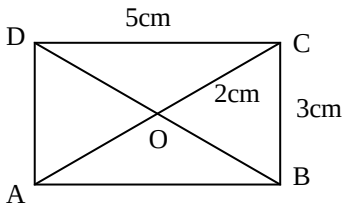
6. Which one of the following set denotes the sides of a triangle.

a) {2,3,6} b) {2,2,5} c) (4, 5, 6} d) None of the above

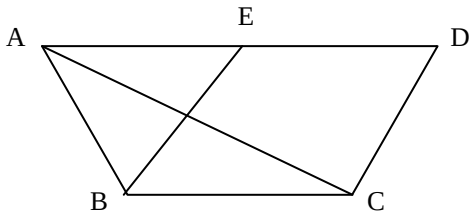
7. On the rectangle ABCD the measure of OB is ……..

a) 2cm b) 3cm

c) 4cm d) 5cm



8. Which one of the following gives the correct relation horn the figure.



a) ΔABE = ½ □ BCDE

b) ΔABE = ΔABC

c) ΔABC = ½ □ BCDE

d) ΔABQ = 2□ BCDE

9. Which one of the following is correct?

a) The angles have the similar shape, they are called the similar angles.

b) Two equiangular triangles are similar.

c) All congruent triangles are similar but all similar triangles may not be congruent.

d) All of the above.

10. Which is correct relation of Pythagoras theorem?

a) $h^2 + p^2 = b^2$ b) $h^2 + b^2 = p^2$

c) $h^2 = p^2 + b^2$ d) $h^2 = p^2 - b^2$

11. In a triangle, when one of its angle is right angle is said to be …….

a) Acute angle triangle b) Obtuse angle triangle

c) Right angle triangle d) Acute and Obtuse angle triangle

12. Which one of the following is the correct property of triangle?

a) The sum of two angles of a triangle is equal to two right angles.

b) The sum of the length of any two sides of a triangle is always greater than the length of third side.

c) In an isosceles triangle, angles opposite to the equal sides are always equal or sides opposite to the equal angles are riot always equal.

d) All of the above.

13. Which of the following is the property of parallelogram?

a) The opposite sides are equal.

b) The diagonal bisect each other.

c) The opposite angles are equal.

d) All of the above

14. The exterior angle of a triangle is equal to the sum of the opposite …….

a) One interior angles b) Two interior angles

c) Three interior angles d) Both 'a' and 'b'

15. A scalene triangle, when all of its sides are ……

a) Not equal b) Equal c) Double d)All of the them

16. Which one of the following is correct if the angles of triangle are in the ratio 1:2:3:

a) 30°:60°:90° b) 30°:90°:90°

c) 60°:30°:90° d) 90°:30°:60°

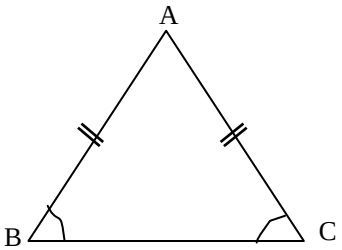
17. The sum of two sides of a triangle is …….

a) Greater than the third side. b) Less than the third side.

c) Equal to the third side. d) None of them

18. From the figure, which types of triangle?

a) Isosceles b) Scalene



c) Right d) None of them

19. A parallelogram in which one of the angle is a Right Angle is said to be ….

a) Rhombus b) Rectangle

c) Square d) All of the above.

20. Which one of the following the correct characteristics of Rhombus.?

a) One angle is Right Angle b) All angle is Right Angle

c) Two adjacent sides are equal. d) Two adjacent sides are equal but non of the angles are Right Angle.

21. Which statement is correct statement?

a) Each angle of a rectangle is a Right Angle.

b) The diagonals of a rectangle are equal.

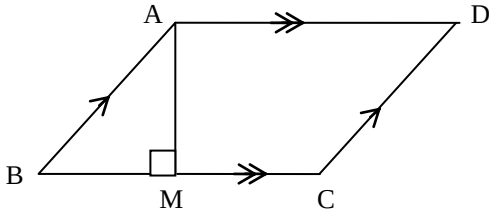
c) All the sides and angles of a square are equal.

d) All of the above.

22. If AD = 6cm and AM = 4 cm, then what is area of ▭ABMC ?

a) 24 cm b) 10cm

c) 8 cm d) 32 cm



23. Which one of the following condition is not correct for the congruency of two triangles.

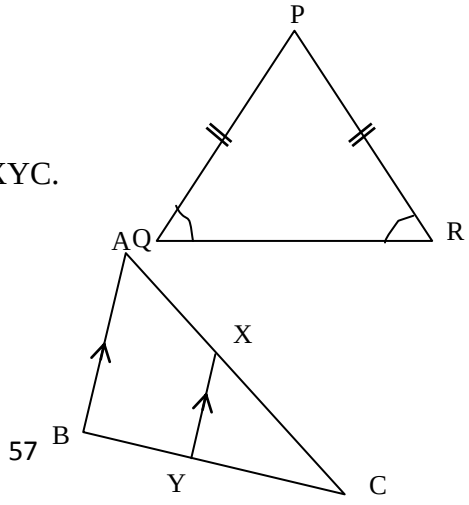
a) A. A. A. b) S. A. S.

c) S.S.S. d) A.S.A.

24. In which axiom is used for ΔABC ~ ΔXYC.

a) A.A.A. Axiom

b) S.A.S. Axiom



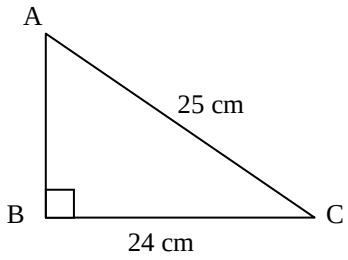
c) S.S.S. Axiom

d) All of the above

25. What is the length of the remaining sides AB ?

a) 49 cm b) 7 cm

c) 69 cm d) 23 cm



26. A line passes through the mid-point of two sides of a triangle them which relation is true of following for third side.

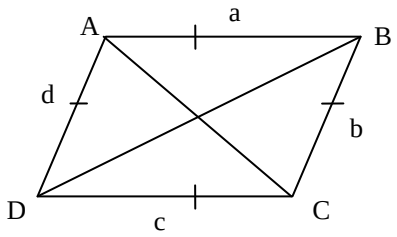
a) Perpendicular b) Parallel

c) Equal d) None of them

27. If a + b + c + d = 12 cm them what is t he length of CA ? From the along side figure.

a) 3 cm b) 4 cm

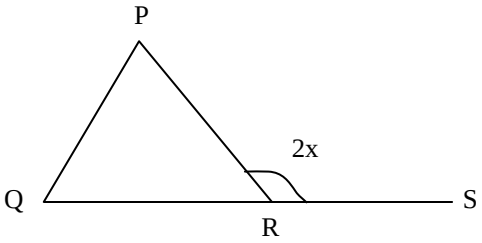
c) 6 cm d) 8 cm



28. What is the value of $\angle P + \angle Q$ if x is 55°.

a) 19° b) 110°

c) 47° d) 90°



29. The bisector of the vertical angle of an isosceles triangle is …….

a) Perpendicular to base b) Bisect the base

c) Perpendicular & bisect the base d) All of the above.

30. If two angles of a triangle are equal, then the sides opposite to them are …..

a) Equal b) Less c) Greater d) None of them

31. The diagonals of square is ……

a) Perpendicular to each other b) Bisect to each other

c) Perpendicular & bisect to each other d) All of the above

32. The diagonals parallelogram is ……..

a) Perpendicular to each b) Bisect to each other

c) Perpendicular & bisect to each other d) All of the them

33. Two straight line intersect at a point then it's opposite angle are

a) Equal b) 180° c) 90° d) None of them

34. The diagonals of a rhombus bisects each other at ……..

a) 450 b) 900 c) 1800 d) None of the above

35. The diagonals of a rectangle are ……..

a) Not Equal b) Equal c) Perpendicular d) All of the above

36. If one angle of a rhombus is right angle, the rhombus is ……

a) A Square b) A Perpendicular

c) A Rectangle d) None of the above

37. Which one of the following is the area of trapezium ?

a) ½ (height x sum of the parallel sides)

b) ½ (height + sum of the parallel sides)

c) ½ (height x difference of the parallel sides)

d) None of the above

38. Which one of the following is area of quadrilateral?

a) ½ (diagonal x sum of the perpendicular on it form the opposite vertices.

b) ½ (height x sum of the parallel sides)

c) ½ diagonal x sum of the parallel sides.

d) Diagonal x sum of the perpendicular on it form the opposite vertices.

39. If two triangles are similar then.

a) Corresponding angle bisectors are proportional to their corresponding sides.

b) Corresponding altitudes are proportional to their corresponding sides. -

c) Corresponding medians are proportional to their corresponding sides.

d) All of the above

40. Which one of the following is correct property of similar polygons?

a) Corresponding angles are equal.

b) Corresponding sides are proportional.

c) Corresponding diagonals are proportional.

d) All of the above

41. Area of equilateral triangle is ……..

a) $\frac{\sqrt{3}}{4}a^2$ b) $\frac{\sqrt{3}}{2}a^2$ c) $\sqrt{3a^2}$ d) $\frac{\sqrt{3}}{2}a^3$

42. Area of rhombus is …….

a) A = Side × height b) A = base × height

c) A = length × breadth d) None of the above.

43. What is the relation of the distance of the equal chord of a circle from the center ?

a) Equal b) Unequal

c) Bisect d) Perpendicular

44. What is the value of degree of a circle ?

a) 220° b) 180°

c) 270° d) 360°

45. What does the perpendicular drawn from the centre of a circle on a chord to the chord ?

a) Bisect b) Perpendicular c) Parallelogram d) Equal

46. What is the formula of circumference of circle ?

a) 2r b) $2\pi r$

c) πr^2 d) $2\pi rh$

47. What is the relation between radius and diameter ?

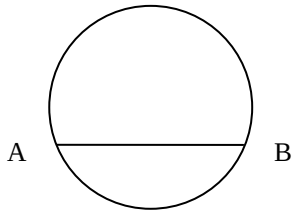
a) d = 2r b) d = r

c) d = 3r d) d = 4r

48. What is the name of the line AB ?

a) Radius b) Circumference

c) Chord d) Arc



49. What is the formula of area of circle ?

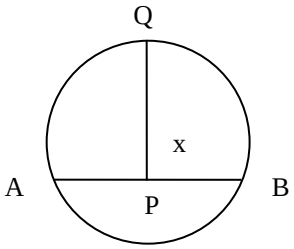
a) $2\pi r$ b) πr^2

c) πr d) $2\pi rh$

50. In figure PQ⊥AB, ∠x = 90°, then what is the relation of AP and BP.

a) Unequal b) Equal

c) AP > BP d) AP < BP



APPENDIX-B

The Achievement Test (Post-test)

Time:-1:30 F.M.:-40

Class:-IX P.M.:-12.5

Attempt all the questions.

Tick (√) the best answers.

1. In a Triangle, one of its angle is right angle is said to be ……

   a) Acute angle triangle b) Obtuse angle triangle

   c) Right angle triangle d) None of the above

2. The sum of the angles of a triangle is always ……..

   a) 90° b) 180° c) 270° d) 360°

3. Which one of the following is correct if the angles of triangle are in the ratio 1:2:3.

   a)30°:60°:90° b) 30°:90°:90°

   c) 60° : 30° : 90° d) 90° : 30° : 60°

4. The bisector of the vertical angle of an isosceles triangle is

   a) Perpendicular to base b) Bisect the base

   c) Perpendicular & bisect the base. d) All of the above

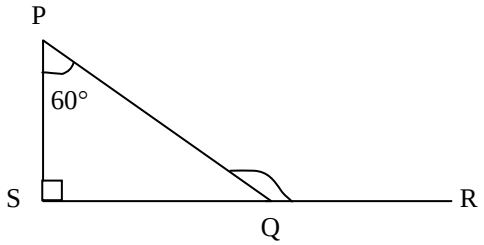
5. Which one of the following is the value of x?

   a) 90° b) 60° c) 45° d) 180°

6. What is the value of < PQR ?

   a) 90° b) 60°

   c) 120° c) 30°

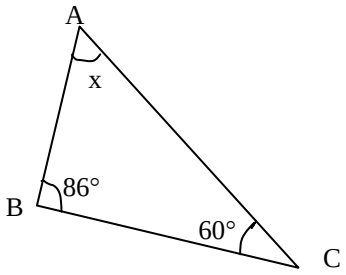


7. If two angles of a triangle are equal, then the sides opposite to them are …

a) Equal b) Less c) Greater d) None of the above.

8. What is the value of x ?

a)44° b) 64° c) 74° d) 34°



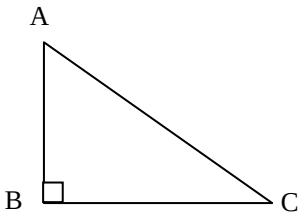
9. Two straight line intersect at a point then it's opposite angle are …….

a) Equal b) 180° c) 90° d) None of the above.

10. From the figure, which types of triangle ?

a) Isosceles b) Scalane

c) Right d) None of them



11. A parallelogram in which all of the angle is right angle is said to be ….

a) Rhombus b) Rectangular c) Square d) All of the above.

12. Which statement is correct statement <

a) The diagonals of a rectangle are equal.

b) Each angle of a rectangle is a right angle.

c) All the sides and angle of a square are equal.

d) All of the above.

13. Which one the following is Correct?

a) In an isosceles triangle, angles opposite to the equal sides are always equal or sides opposite to the equal angles are not always equal.

b) The sum of two angles of a triangle is equal to 180^0

c) The sum of the length of any two sides of a triangle is always greater than the length of third side.

d) All of the above.

14. A parallelogram in which one of the angle is right angle is said to be …..

a) Rhombus b) Rectangle

c) Square d) All of the above

15. The opposite angles and sides of a parallelogram are ……..

a) Equal c) Less

c) Greater d) None of the above.

16. What is area of triangle?

a) $A = \frac{1}{2}(b \times h)$ b) $A = \sqrt{s(s - a)(s - b)(s - c)}$

c) (a) & (b) d) None of the above.

17. What is area of Rhombus ?

a) A = Side × height b) A = length × breadth

c) A = Side × breadth d) None of the above.

18. What is the area of equilateral triangle having 6cm length?

a) $9\sqrt{3}$ cm^2 b) $6\sqrt{3}$ cm^2 c) $2\sqrt{3}$ cm^2 d) None of the above.

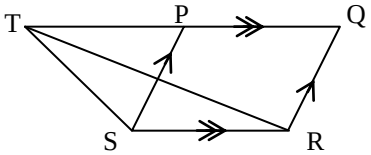
19. What is area of triangle whose length of sides are, a = 7cm, b = 6cm and c = 5cm ?

a) $6\sqrt{6}$ cm^2 b) $6\sqrt{3}$ cm^2 c) $2\sqrt{3}$ cm^2 d) None of the above.

20. In the given figure, Area of □ PQRS is $36cm^2$, then what is the area of ΔSTR?

a) $9cm^2$ b) $6cm^2$

c) $12cm^2$ d) $18cm^2$



21. Which one of the following set denotes the sides of a triangle?

a) (3, 4, 5 } b) {5,12, 13 }

c) {7, 24, 25} d) All of the above

22. What is the diagonals of square having length of sides are ‘a’ cm?

a) $a\sqrt{2}$ b) $a^2\sqrt{2}$ c) 2a d) $2\sqrt{a}$

23. What is the value of x of right angle triangle with sides of length are 3 cm, 4cm and × cm ?

a) 3cm b) 4cm c) 5cm d) 7cm

24. ΔABC and ΔXYC are similar then which of the following condition follow?

a) $\frac{AB}{XY} = \frac{BC}{YC}$ b) $\frac{XY}{AB} = \frac{YC}{AC}$ c) $\frac{AC}{CX} = \frac{BC}{YC}$

d) All of the above

25. Which one of the following is correct ?

a) The angles have the similar shape, they are called the similar triangle.

b) Two equiangular triangles are similar.

c) All congruent triangles are similar but all similar triangles may not be congruent.

d) All of the above

26. Which one of the following is correct property of similar polygons?

a) Corresponding angles are equal.

b) Corresponding sides are proportional

c) Corresponding diagonals are proportional.

d) All of the above

27. All congruent triangles are similar but all similar triangles are …

a) May be congruent b) May not be congruent

c) Congruent d) None of the above

28. If the opposite sides of a quadrilateral are equal then the quadrilateral is ….

a) Rhombus b) Parallelogram

c) Square d) All of the above.

29. The diagonals of parallelogram is ……

a) Bisect each other b) Perpendicular each other

c) Perpendicular & bisect to each other d) None of the above.

30. Which statement is correct statement?

a) The exterior angle of a triangle is equal to the sum of the two opposite interior angles.

b) The sum of two sides of a triangle is greater than the third side.

c) If two angles of a triangle are equal then the side opposite to them are also equal.

d) All of the above.

31. If two triangles are similar then

a) Corresponding angle bisectors are proportional to their corresponding sides.

b) Corresponding altitudes are propositional to their corresponding sides.

c) Corresponding medians are proportional to their corresponding sides.

d) All of the above. .

32. The square of the hypotenuses of a right angled triangle is equal to the sum of squares of the other …….

a) One side b) Two side

c) Three side d) None of the them.

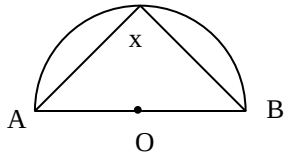
33. The diagonals of a rhombus bisects each other at …….

a) 45° b) 90° c) 180° d) None of the above

34. Which one of the following condition is correct for the congruency of two triangles?

a) S.A.S. b) S.S.S. c) A.S.A. d) All of the above

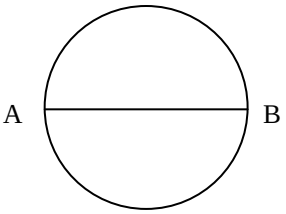
35. In the given figure O is the centre of the semi-circle then what is the value of x ?



a) 60° b) 90°

c) 120° d) 180°

36. What is the name of the line AB ?



a) Radius b) Circumference

c) Diameter d) Arc

37. What is the area of circle whose radius is r = 7 cm ?

a) 152 cm^2 b) 154 cm^2 c) 156 cm^2 d) 158 cm^2

38. What is the formula of circumference of circle ?

a) 2r b) $2\pi r$

c) πr^2 d) $2\pi rh$

39. What is the relation between radius and diameter ?

a) d = 2r b) d = r

c) d = 3r d) d = 4r

40. What is the circumference of circle whose radius is r = 14 cm ?

a) 78 cm^2 b) 87 cm^2 c) 88 cm^2 d) 98 cm^2

APPENDIX- C

A Model of Teaching Process in Class Room

For Experimental Group (Inductive to Deductive Method)

School: Shree Samundra H. S. School Date:2073/05/15

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives

   At the end of the class students will be able to

   (a) Show that the sum of the angles of a triangle is 180°

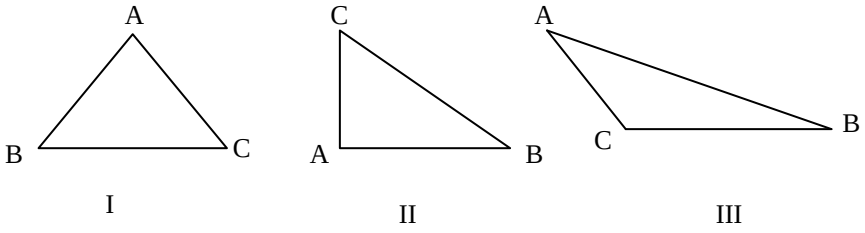
2. Teaching Materials:

   Daily use materials and different shapes and sizes of triangle, geometry box

3. Teaching Activities:

   a) Discussion about angle and triangle.

   - What are angles and triangles?
   - How many angles are there in a triangle and how many sides?
   - How it ever occurred to you that the angle sum for different triangles might possible be different?

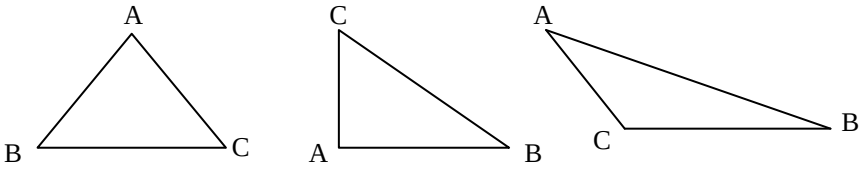


   - Do you think the different triangles have different angles sum?
   - Do the bigger triangles have angle sum greater than smaller triangle of the same shape?

- Do the obtuse angle triangles have angle sum greater than acute angle triangles

b) Today we discuss about the angle sum of a triangle

Step i) Let us draw three triangles with different shapes and sizes.



Step ii) Measure the angles of each triangle and tabulate the results.

Figure	∠A	∠B	∠C	∠A+∠B+∠C	Remarks
(i)					∠A+∠B+∠C =180°
(ii)					∠A+∠B+∠C =180°
(iii)					∠A+∠B+∠C =180°

Conclusion: The sum of three angles of a triangle is equal to 180°

c) Discuss further how theoretical proof is to be accomplished to establish the truth of the statement and continue discussing to establish the

Proof

i) Given

ii) To be proved

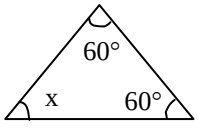
iii) Plan

iv) Complete form of proof according to statement

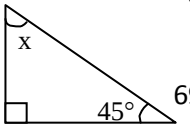
4. Evaluation: i) What is the sum of three angles of a triangle?

5. Home-Work: Find the value of x.

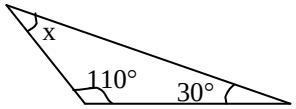
a)



b)



c)



APPENDIX- D

Model of Lesson Plan for Control Group (Deductive Method)

School: Shree Samundra H.S. School Date:2073/05/15

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives:

   After the completion of this class the students will be able to

   a) Show that the sum of the angles of a triangle is 180°

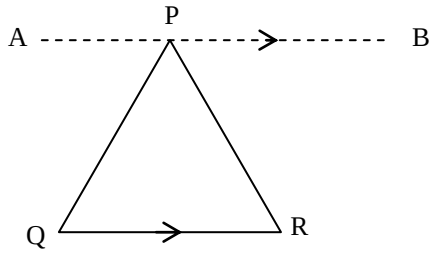
2. Teaching Materials:

   Daily use materials:

3. Teaching activities:

   Given: PQR is a triangle

   $\angle PQR$, $\angle QPR$ and $\angle PRQ$ are the angles of the triangle.



   To prove: $\angle PQR+\angle QRP+\angle PRQ=180^\circ$

Construction: Through the vertex P, draw AB parallel to QR.

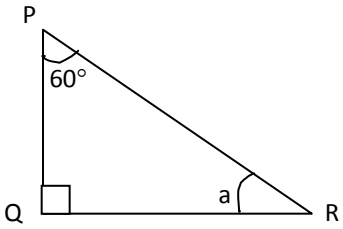
Proof:

S.N.	Statement	S.N.	Reasons
1.	∠APB=2 Right Angle	1.	Straight Angle
2.	∠APQ=∠PQR	2.	AB‖QR,& Alternate Angles
3.	∠BPR=∠PRQ	3.	AB‖QR,& Alternate Angles
4.	∠APQ+∠QPR+∠BPR=∠APB	4.	Whole part Axiom
5.	∠PQR+∠QPR+∠PRQ=∠180°	5.	From (1),(2),(3)&(4)

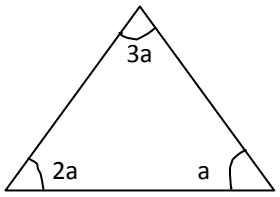
4. Evaluation: What is the sum of the angles of a triangle?

5. Home-Work: Find the value of a.

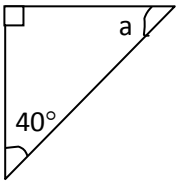
a)



b)



c)



APPENDIX- E

A Model of Teaching Process in Class Room

For Experimental Group (Inductive to Deductive Method)

School: Shree Samundra H. S. School Date:2073/05/16

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives

At the end of the class students will be able to

(a) Show that the exterior angle of a triangle is equal to the sum of the two opposite interior angles.

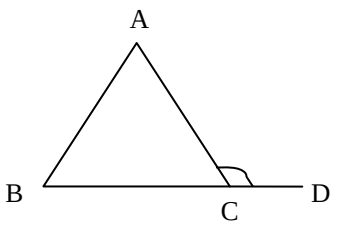
2. Teaching Materials:

Daily use materials and different shapes and sizes of triangle, geometry box

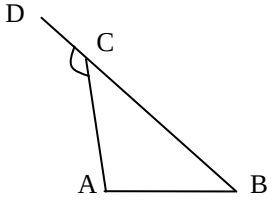
3. Teaching Activities:

d) Discussion about angle and triangle.

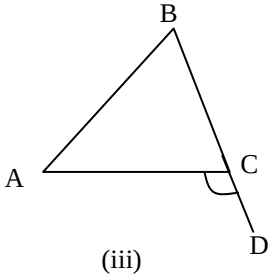
- Re-call the yesterday course?
- What are the exterior and interior angles?



(i)



(ii)



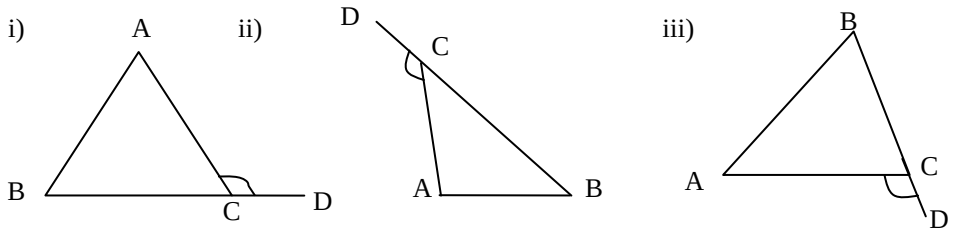
(iii)

- Do you think the different triangles have different angles sum?

- Do you think the sum of two opposite interior angles and measure the exterior angle?

b) Today we discuss about the exterior angle of a triangle is equal to the sum of the two opposite interior angles.

Step i) Let us draw three triangles with different shapes and sizes.



Step ii) Measure the exterior angle and the opposite interior angles of each triangle and tabulate the results.

Figure	∠ABC	∠BAC	∠ABC+∠BAC	∠ACD	Remarks
(i)					∠ABC+∠BAC=∠ACD
(ii)					∠ABC+∠BAC=∠ACD
(iii)					∠ABC+∠BAC=∠ACD

Conclusion: The exterior angle of a triangle is equal to the sum of the two opposite interior angles.

c) Discuss further how theoretical proof is to be accomplished to establish the truth of the statement and continue discussing to establish the

Proof

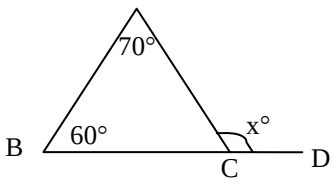
i) Given ii) To be proved

iii) Plan iv) Complete form of proof according to statement

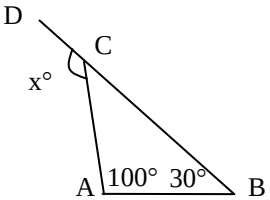
4. Evaluation: i) What is the relation between the exterior angle and the two opposite interior angles of a triangles?

5. Home-work : Find the value of x.

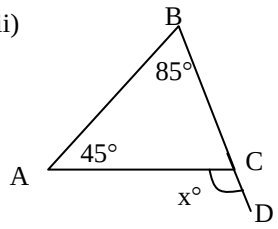
i)



ii)



iii)



APPENDIX- F

Model of Lesson Plan for Control Group (Deductive Method)

School: Shree Samundra H.S. School Date:2073/05/16

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives:

   After the completion of this class the students will be able to

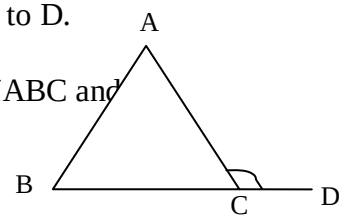
   a) Show that the exterior angle of a triangle is equal to the sum of the two opposite interior angles.

2. Teaching Materials:

   Daily use materials:

3. Teaching activities:

   Given: In triangle ABC, the side BC is produced to D. ∠ACD is the exterior angle so formed. ∠ABC and ∠BAC are the opposite interior angles.



   To prove: ∠ABC+∠BAC=∠ACD

Proof:

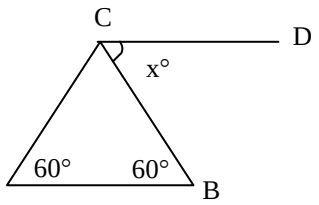
S.N.	Statement	S.N.	Reasons
1.	∠BCA+∠ACD=∠BCD	1.	Whole part axiom
2.	$\angle BCA+\angle ACD=180^0$	2.	BCD is a straight angle
3.	$\angle ABC+\angle BCA+\angle BAC=180^0$	3.	Sum of the angles of a triangle
4.	∠BCA+∠ACD=∠ABC+∠BCA+ ∠BAC	4.	From statements (2) and (3)
5.	∠ABC+∠BAC=∠ACD	5.	Cancelling ∠BCA from both

			sides of statement (4)

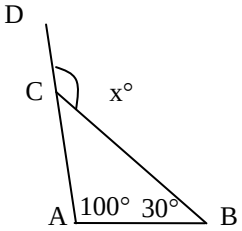
4) Evaluation: What is the relation between the exterior angle and the two opposite interior angle of a triangle?

5) Home- Work: Find the value of x.

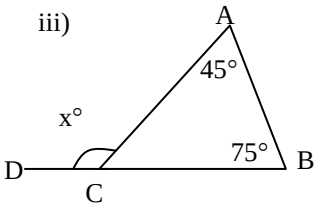
i)



ii)



iii)



APPENDIX- G

A Model of Teaching Process in Class Room

For Experimental Group (Inductive to Deductive Method)

School: Shree Samundra H. S. School Date:2073/05/17

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives

   At the end of the class students will be able to

   (a) Show that the base angles of an isosceles triangles are equal.

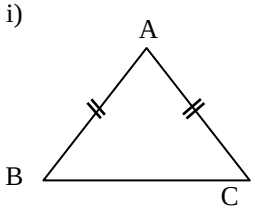
2. Teaching Materials:

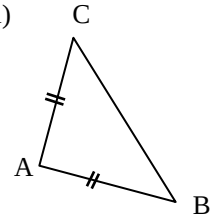
   Daily use materials and different shapes and sizes of isosceles triangle, geometry box

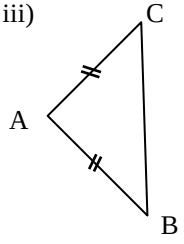
3. Teaching Activities:

   e) Discussion about angle and triangle.

   - What is isosceles triangles?
   - What is congruence of a triangle?
   - What are the condition of two triangles are congruency?
   - Discuss about the properties of congruency triangles are SAS, ASA, SSS, RHS and AAS
   - Draw the figure and what are the base angles of an isosceles triangles?

i) 

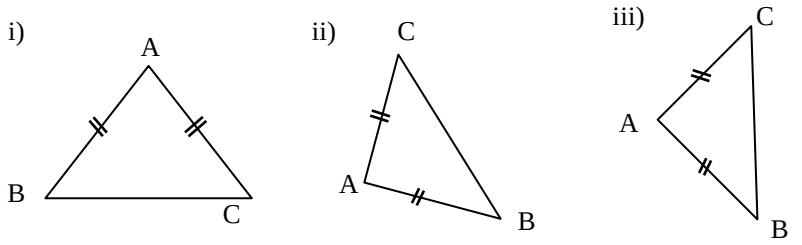
ii) 

iii) 

- Do you think the different isosceles triangles have different angles sum?
- Do the bigger triangle have base angles greater than smaller triangle of the same shape?

d) Today we discuss about the base angles of an isosceles triangles are equal.

Step i) Let us draw three isosceles triangles with different shapes and sizes.



Step ii) Measure the base angles of each triangle and tabulate the results.

Figure	Angles opposite to the equal sides (Base angles)		Remarks
	∠ABC	∠ACB	
(i)			∠ABC=∠ACB
(ii)			∠ABC=∠ACB
(iii)			∠ABC=∠ACB

Conclusion: Base angles of an isosceles triangles are equal.

c) Discuss further how theoretical proof is to be accomplished to establish the truth of the statement and continue discussing to establish the

Proof

i) Given

ii) To be proved

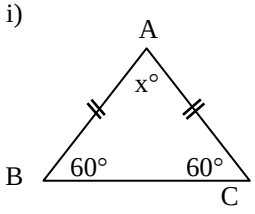
iii) Plan

iv) Complete form of proof according to statement

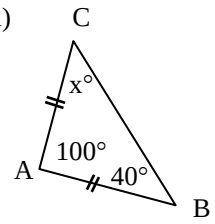
4. Evaluation: i) What is the relation between the base angles of an isosceles triangles?

5. Home-work : Find value of x.

i)



ii)



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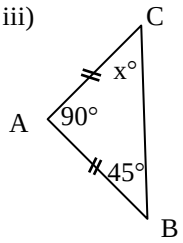


APPENDIX- H

Model of Lesson Plan for Control Group (Deductive Method)

School: Shree Samundra H.S. School Date:2073/05/17

Unit : Geometry Time: 45 mins

Topic : Triangle Class: 9

1. Specific Objectives:

After the completion of this class the students will be able to

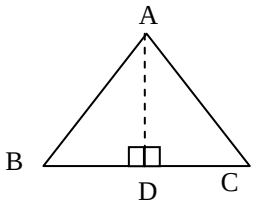
a) Show that the base angles of an isosceles triangles are equal.

2. Teaching Materials:

Daily use materials:

3. Teaching activities:

Given: In isosceles triangle ABC, AB = AC



To prove: $\angle ABC = \angle ACB$

Construction: From the vertex A, $AD \perp BC$ is drawn.

Proof:

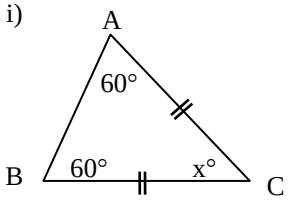
S.N.	Statement	S.N.	Reasons
1.	In ΔABD and ΔACD	1.	
i.	$\angle ADB = \angle ADC$ (R)	i.	By construction, $AD \perp BC$
ii.	AB = AC (H)	ii.	Given
iii.	AD = AD (S)	iii.	Common side
iv.	$\Delta ABD \cong \Delta ACD$	iv.	R.H.S. axiom

2.	$\angle ABD = \angle ACD$ i.e. $\angle ABC = \angle ACB$	2.	Corresponding angles of congruent triangle.

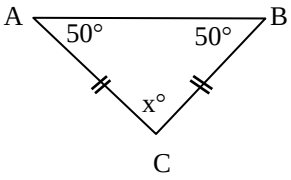
4) Evaluation: What is the relation between base angles of an isosceles triangles.

5) Home-Work: Find the value of x.

i)



ii)



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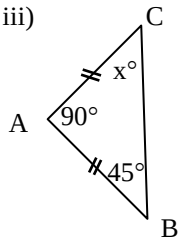


APPENDIX- I

A Model of Teaching Process in Class Room

For Experimental Group (Inductive to Deductive Method)

School: Shree Samundra H. S. School Date:2073/05/20

Unit : Geometry Time: 45 mins

Topic : Parallelogram Class: 9

1. Specific Objectives

   At the end of the class students will be able to

   (a) Show that the opposite angles and sides of a parallelogram are equal.

2. Teaching Materials:

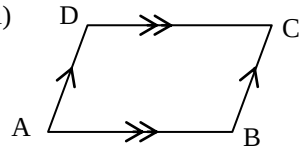
   Daily use materials and different shapes and sizes of parallelogram, geometry box

3. Teaching Activities:

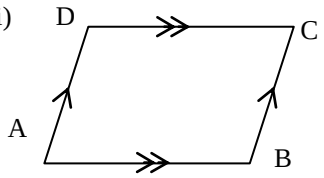
   a) Discussion about the quadrilateral and parallelogram.

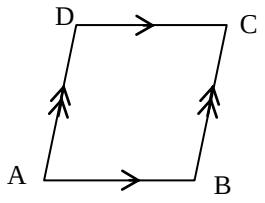
   - What is quadrilateral and parallelogram?
   - How many types of parallelogram?
   - Discuss about the some special types of parallelogram are Rectangle, Square, Rhombus.

i)



ii)

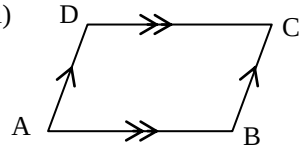


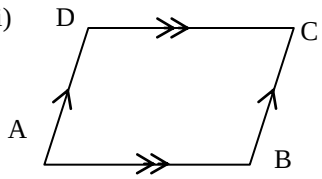
iii) 

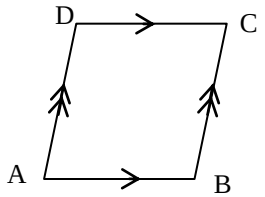
- Do you think the different parallelograms measure the opposite sides and opposite angles are same?
- Do the bigger parallelograms have opposite angles and sides greater than smaller parallelograms of the same shape?

b) Today we discuss about the opposite angles and sides of a parallelogram are equal.

Step i) Let us draw three parallelograms with different shapes an sizes.

i) 

ii) 

iii) 

Step ii) Measure the opposite angles and sides of each parallelograms and tabulate the results.

Figure	∠ABC	∠ADC	AB	CD	Remarks
(i)					∠ABC=∠ADC, AB=CD
(ii)					∠ABC=∠ADC, AB=CD
(iii)					∠ABC=∠ADC, AB=CD

Conclusion: The opposite angles and sides of a parallelograms are equal.

c) Discuss further how theoretical proof is to be accomplished to establish the truth of the statement and continue discussing to establish the

Proof

i) Given

ii) To be proved

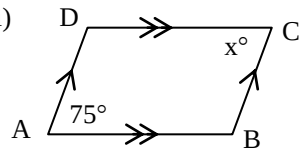
iii) Plan

iv) Complete form of proof according to statement

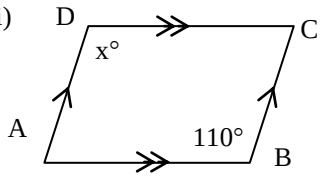
4. Evaluation: i) What is the relation between the opposite angles and sides of a parallelogram ?

5) Home-Work: Find the value of x.

i)



ii)



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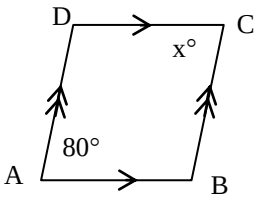


APPENDIX- J

Model of Lesson Plan for Control Group (Deductive Method)

School: Shree Samundra H.S. School Date:2073/05/20

Unit : Geometry Time: 45 mins

Topic : parallelogram Class: 9

1. Specific Objectives:

   After the completion of this class the students will be able to

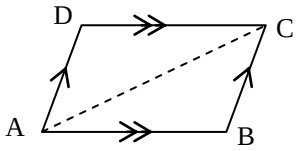
   a) Show that the opposite angles and sides of a parallelogram are equal.

2. Teaching Materials:

   Daily use materials:

3. Teaching activities:

   Given: ABCD is a parallelogram in which AB // DC and AD // BC



   To prove: (i) $\angle ABC = \angle ADC$, $\angle BAD = \angle BCD$

   (ii) AB = DC, AD = BC

   Construction: Diagonal AC is drawn.

Proof:

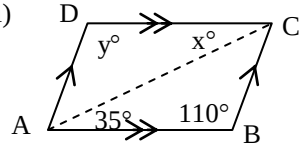
S.N.	Statement	S.N.	Reasons
1.	In Δ ABC and ΔACD	1.	
i) ii) iii) iv)	∠BAC=∠ACD (A) AC = AC (S) ∠ACB=∠CAD (A) ∴ΔABC ≅ ΔACD	i) ii) iii) iv)	AB||DC and alternate angles. Common side AD||BC and alternate angles A.S.A. axiom
2.	∠ABC=∠ADC	3.	Corresponding angles of congruent triangles.
3.	∠BAD = ∠BCD	3.	Drawing the diagonal BD and same as above in ΔABD and ΔBCD.
4.	AB=DC and AD=BC	4.	Corresponding sides of congruent triangles.

4) Evaluation: (i) What is parallelogram?

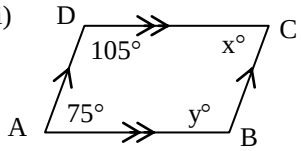
(ii) What is rectangle, Square and Rhombus?

5) Home- Work: Find the value of x and y.

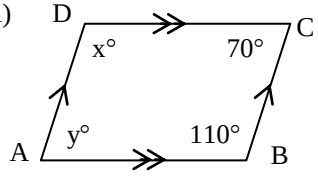
i)



ii)



iii)



APPENDIX-K

Split-half Reliability Calculation for Pretest

Students	Odd	Even	Sum	Difference
A	23	22	45 H	1
B	22	21	43 H	1
C	23	19	42 H	4 H
D	22	18	40 H	4 H
E	20	18	38 H	2
F	18	19	37	-1 L
G	19	17	36	2
H	19	16	35	3 H
I	18	16	34	2
J	18	14	32	4 H
K	18	13	31	5 H
L	14	12	26	2
M	13	11	24	2
N	12	11	23	1
O	11	12	23	-1 L
P	9	11	20 L	-2 L
Q	10	10	20 L	0
R	9	10	19 L	-1 L
S	9	7	16 L	2
T	7	8	15 L	-1 L

Sum of five highest = 208 = 20

Sum of five lowest = 90 = -5

Difference D_s = 118 D_d = 25

Difference D_s^2 = 13924 D_d^2 = 625

By formula,

$$r_{tt} = 1 - \frac{625}{13924}$$

$$= 1 - 0.0448865269$$

$$= 0.95511$$

APPENDIX-L

Split-half Reliability Calculation for Posttest

Students	Odd	Even	Sum	Difference
A	20	18	38 H	2
B	19	15	34 H	4 H
C	16	20	36 H	-4 L
D	20	17	37 H	3 H
E	16	15	31	1
F	9	10	19	-1 L
G	11	12	23	-1 L
H	15	13	28	2
I	21	16	37 H	5 H
J	14	10	24	4 H
K	11	6	17	5 H
L	9	7	16	2
M	8	8	16	2
N	6	3	9 L	3
O	4	4	8 L	0
P	4	4	8 L	0
Q	3	4	7 L	-1 L
R	2	3	5 L	-1 L

Sum of five highest = 182 = 21

Sum of five lowest = 37 = -8

Difference D_s = 145 D_d = 29

Difference D_s^2 = 21025 D_d^2 = 841

By formula,

$$r_{tt} = 1 - \frac{841}{21025}$$

$$= 1 - 0.04$$

$$= 0.96$$

APPENDIX- M

Pretest result of the experimental and control groups

(Required scores arranged in decending order)

S.N.	Experimental Group		Control Group	
	Score	Frequency	Score	Frequency
1	38	1	38	1
2	37	1	37	2
3	36	2	35	1
4	35	2	34	1
5	34	1	33	2
6	33	1	32	1
7	31	2	31	1
8	28	1	30	2
9	27	1	28	1
10	26	1	27	1
11	25	1	26	1
12	24	1	24	1
13	23	1	22	1
14	22	1	20	1
15	19	1	17	1

Total Students	18	Total Students	18
Mean	30	Mean	29.67
Variance	32.555	Variance	34.555
Standard deviation	5.705	Standard deviation	5.878
Co-efficient of co-relation (r)			0.983
Value of student's distribution (t)			1.26

APPENDIX- N

MEAN, S.D., VARIANCE AND T-TEST CALCULATION FOR PRE-TEST

S.N	E- GROUP		C-GROUP		$x_1=X_1-\bar{X}_1$	x_1^2	f_1x_1	$x_2=X_2-\bar{X}_2$	x_2^2	f_2x_2	x_1x_2	$f_1x_1^2$	$f_2x_2^2$
	X_1	f_1	X_2	f_2									
1	38	1	38	1	8	64	8	8.33	69.3	8.3	66.6	64	69.38
2	37	1	37	2	7	49	7	7.33	53.7	14.6	51.3	49	107.45
3	36	2	35	1	6	36	12	5.33	28.4	5.3	31.9	72	28.40
4	35	2	34	1	5	25	10	4.33	18.7	4.3	21.6	50	18.74
5	34	1	33	2	4	16	4	3.33	11.1	6.6	13.32	16	22.17
6	33	1	32	1	3	9	3	2.33	5.4	2.3	6.99	9	5.42
7	31	2	31	1	1	1	2	1.33	1.7	1.3	1.33	2	1.76
8	28	1	30	2	-2	4	-2	0.33	0.1	0.3	-0.66	4	0.21
9	27	1	28	1	-3	9	-3	-1.67	2.7	-1.6	5.01	9	2.78
10	26	1	27	1	-4	16	-4	-2.67	7.1	-2.6	10.68	16	7.12
11	25	1	26	1	-5	25	-5	-3.67	13.4	-3.6	18.35	25	13.46
12	24	1	24	1	-6	36	-6	-5.67	32.1	-5.6	34.02	36	32.14
13	23	1	22	1	-7	49	-7	-7.67	58.8	-7.6	53.69	49	58.82
14	22	1	2o	1	-8	64	-8	-9.67	93.5	-9.6	77.36	64	93.50
15	19	1	17	1	-11	121	-11	-12.6	160.5	-12.6	139.37	121	160.52
		$N_1=18$		$N_2=18$		$\Sigma x_1^2=524$			$\Sigma x_2^2=556.94$		$\Sigma x_1x_2=531.04$		$\Sigma f_2x_2^2=622$

APPENDIX- O

Posttest result of the experimental and control groups

(Required scores arranged in descending order)

S.N.	Experimental Group		Control Group	
	Score	Frequency	Score	Frequency
1	29	1	26	1
2	28	1	25	1
3	27	2	24	1
4	26	1	23	1
5	25	1	22	1
6	24	2	20	2
7	22	1	19	1
8	21	1	18	1
9	20	1	17	1
10	19	2	16	2
11	18	1	15	1
12	16	1	14	1
13	15	1	13	2
14	13	1	11	1
15	10	1	10	1
Total Students		18	Total Students	18
Mean		21.27	Mean	17.88
Variance		25.67	Variance	20.21
Standard deviation		5.066	Standard deviation	4.495
Co-efficient of co-relation (r)				0.984
Value of student's distribution (t)				13.89

APPENDIX- P

STATISTICAL FORMULAS AND SYMBOLS USED FOR DATA ANALYSIS

1. Mean

$$\bar{x} = \frac{\Sigma fX}{N}$$

2. Variance of Statistics

$$S^2 = \frac{\Sigma fx^2}{N}$$

3. Standard Deviation of Statistics

$$S = \sqrt{\frac{\Sigma fx^2}{N}}$$

4. Coefficient of Correlation

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2}\sqrt{\Sigma y^2}}$$

5. t-test for Correlated Groups

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{S_1^2}{N_1} + \frac{S_2^2}{N_2} - 2r\left(\frac{S_1}{\sqrt{N_1}}\right)\left(\frac{S_2}{\sqrt{N_2}}\right)}}$$

Where,

The number of degree of freedom would be the number of pairs minus one i.e. $N_1 - 1$ or $N_2 - 1$

$\bar{x}_1$ = Mean of Experimental Group

$\bar{x}_2$ = Mean of Control Group

S_1^2 = Variance of Experimental Group

S_2^2 = Variance of Control Group

N_1 = Number of Students in Experimental Group

N_2 = Number of Students in Control Group

r = Coefficient of Correlation between the pair of scores