Chapter- I

INTRODUCTION

Background of the Study

Mathematics can be taken as the backbone of all civilizations and geometry is foundation of mathematics. Geometry has been developed into such a field without which the development of other areas of mathematics would have been incomplete. Different method of teaching geometry are developed, among them experimental verification is being largely acceptable because of its great role to improve academic standard of students in geometry.

Eves (1983) on his own book 'An Introduction to History of Mathematics Education' stated that "geometry is the study of properties of shapes. Since the shape of an object is something visible, everyone begin to acquire geometrical knowledge and understanding in early childhood. In pre- Hellenic times some geometrical theorems would probably be considered as obvious and if anyone has had doubts that the person would have convince him by performing simple experiment."

School-mathematics-curricula of Nepal have given emphasis on geometry learning from the beginning of schooling. According to the National Council of Teachers of Mathematics, geometry is one of the "content standards" of school mathematics, which aims at developing spatial reasoning, problem solving skills, and communication (Sellke, 1999). Thus, geometry is regarded as a core content area of school mathematics. The teaching and learning situation is not the same in all schools of Nepal. The majority of public schools have been facing the problems of quality in teaching. On the other hand, very few institutional schools have been implementing student-centred teaching strategies in mathematics teaching. As a result, geometry teaching and learning situations vary accordingly. One of the main student-centred teaching methods in geometry is experimental verification method where all type of the students will participate equally.

Regarding an emphasis on learning geometry the lower secondary school curriculum has mentioned the four steps of learning such as knowledge. Application, problem solving and comprehension (Curriculum Development Centre, 1999). "The

knowledge strand" requires the learners to know definitions, facts and formulae and the emphasis of "application" is on transfer of learning into a novice situation The "problem-solving strand" aims at developing an exposure of use of geometry to solve the day-to-day problems and the fourth strand aims at developing comprehension of geometric concepts, their relationships and structure (Curriculum Development Centre, 1999).

The second issue of geometry learning is contextualisation. The term "contextualisation of learning" refers that learning can be promoted by meaningful contexts and relating instruction to the real-life situation. The learning in Nepalese schools is totally based on textbooks, which have been prepared according to the school curriculum. On the other hand, since the textbooks have been written in formal Nepali language, it is difficult for those students who have other language-speaking background than Nepali. In Nepal, different local and ethnic languages are spoken for such as; Newari, Maithili, Gurung, Rai, Limbu, Tamang, Sherpa and Magar etc. On the other hand, the teachers use the textbook as an ultimate means of teaching that does not provide the opportunity of relating their learning with local context. In order to minimise this problem experimental verification method of teaching may help, this can be useful to learn the geometric concepts.

In teaching of geometry, practical and experimental work such as; observation, drawing or measurement is very important, because these tasks often make students familiar with geometrical figures as well as leading them to discover various geometrical properties. In fact, in today's geometry curriculum in primary and secondary schools, the early stages of geometry often comprise such experimental tasks before deductive geometry.

According to Ernest (1996), the traditional mathematics instruction transmits a view of mathematics as straight forward, logical, absolute and in most cases, disconnected from reality and independent of both learner and teacher. The role of the learner is to listen to the teacher carefully and to learn and understand by doing lots of exercises, one after the other, and preferably by working alone. The role of the learner is also to memorize the facts and rules that are sanctioned by the teacher and to implement them.

Experimental activities have been used in science education since the middle of. 19th century. Experimental teaching method helps to improve students' hand skills, makes them more productive and increases their active involvement in learning. Students can create a relationship between theories and practice by using experimental teaching method and by applying what they learn into their real life problems through experiments, hence they can make their learning more meaningful. Experimental activities encourage reasoning, critical thinking, the understanding of mathematics and also help students to develop the ways of producing knowledge (Akdeniz, 1998) Students should participate in the learning activities so that the knowledge can be students' own product. The main goal to reach for experiment studies is to achieve meaningful learning by putting the theoretical information into practice by proving it.

Butler and Wren (1941) describe the importance of experimental verification as follows: "The informal geometry of the junior high school will constitute the complete geometry program of many students. For those who continue their study of geometry in the senior high school, intuition and experiment will be an effective aid, but the major purpose of instructions will be to instil in the students an appreciation of the significance of logical demonstration, to acquainted them with effective methods of generalization, to train them to the meaning of mathematical rigour and precision".

In our school geometry, we mainly concerned in Euclidian geometry (about line, angle, triangle, parallelograms, regular polygon etc.). We prove them in both way experimentally and theoretically however will it possible. Theoretical proof is the deductive method of the proving the theorem. The logic and reasoning are used to prove the theorem. The reasoning is based on definitions, postulates, axioms and theorems. Other kinds of proof mentioned above haven't been included in our curriculum. The present research is concern only to the experimental and theoretical proof, in the manner of effect of experimental verification of the statement in teaching geometry on lower secondary level.

A priori knowledge consists of propositions which are asserted on the basis of reason alone, without recourse to observations of the world (Ernest, 1991). A priori is a philosophical term that is used in different ways. The term is supposed to mean knowledge that is gained through deduction, and not through empirical evidence.

A posteriori knowledge consists of propositions asserted on the basis of experience that is based on the observations of the world (Woozily, 1949). This type of knowledge is also call empirical knowledge.

Statement of the Problem

Some teachers teach mathematics in classroom with their best but many students are unable to understand mathematics properly. There are many factors which impact in mathematics achievement. Out of them, teaching approach is one of the most influencing factor in achievement of mathematics. So the teachers should selected proper teaching approach to motivate the students to learn and to make learning meaningfully. Most of Nepalese children fact failure in mathematics in school level due to poor teaching learning approach, caring the students participation effecting teaching learning approach contributes students to learn more being achieve.

Mathematics plays an important role in our everyday life, so it is being essential part of school curriculum. Most of the school student takes it as a difficult subject. There is an inactive participation in mathematics learning. Teacher should avoid such problem by providing different opportunities to motivate the students Most of the students feel weak in geometry One of major cases is lack of student centred teaching method in geometry. Hence this study focused on the students centred method in teaching geometry. The study aims to find the answer of the following questions.

- Does the experimental verification have any effect on learning mathematics?
- Does the use of experimental verification before to verify theoretically affect the achievement of students in geometry?

Objectives of the Study

The objectives of this study were as follows:

- To compare the achievements of the students taught by using experimental verification method and traditional method in geometry.
- To analyze the effect of experimental verification in learning geometry at lower secondary level.

Significance of the Study

Mathematics is a technical subject taught at all levels of school curriculum. “How a child learns mathematics?” is an important issue in teaching mathematics. A child can learn effectively if he/she is interested to learn. If the teaching learning process is practical and co-operative, students can learn more. The main theme of teaching mathematics is not the acquisition of knowledge. As a result different theories and ideas of learning are conducted. Almost of psychologist are concentrated towards promoting the students learning. Every classroom have full of diversity due to the different ability of students, so the researcher should respect their learning level.

Teacher’s professional development carries two important aspects, namely - teacher development and professional development. Equipping teachers with relevant knowledge and the methods of effective delivery of the same to the students develop teachers efficiency. As a teachers are one of the main door in teaching learning activities , the most necessary and important aspect of qualities human resources development lies on the shoulder of teachers before quality of the education of the child, teacher education should be moulded in that way. Teacher education involves educationist, managers, experts and teacher students. As the teachers are important instrumental for the implementation of the curriculum, their roles become the most important in teacher development process. The teachers, which are considers well developed for the purpose in higher education, have been academically qualified to take any subjects. High qualification is itself a development of teacher, but still they need the techniques and skill of effective delivery of the contents which is not possible without proper training. The training thus provided to those who have already acquired higher education need such type of training of delivery of knowledge and skill of their subjects. Knowing a lot of in any subject does not make an effective and successful teacher unless she/he take care of lecture delivery in porper curricula. A halphard delivery of very important knowledge makes no sense to receive.

After teacher development, the next stage is teacher professional development. In fact teacher professional development strengthens the purpose of teacher development, which is to raise the quality of education. Because teachers as educators, raising their status and standard to improve teaching- learning activities.

Teacher needs to be up dated with recent knowledge, because they are educators. One of the characteristics of the professional is that professionals from an association and all professionals become the members of their association. Association plays an important role to standardizing knowledge, skill, attitude and habits of its members. Therefore, teacher professional development concern teacher association as well as national development through ethical aspects.

Teachers' professional development includes the acquired, skilled and emotional intelligence through formal education and trainings along with the induction direct and second hand experience of the whole teaching career through a number of trajectories of achieving self-awareness and future direction in teaching.

Also the experimental verification was not used on the base of skill level of students on previous thesis Thus, this study is done to determine whether the experimental verification raise or didn't raise the learning outcomes of students in mathematics.

Hence this study have following significance:

- It helps to make the classroom environment more interesting.
- It helps to the teacher to choose the best way of teaching geometrical proof.
- It helps to the curriculum designer to find the important of experimental verification in teaching geometry.
- This study should help to make the students familiar with the geometrical instruments and their uses.

Hypothesis of the Study

1. Statistical Hypothesis

The null and alternative hypotheses formulated for this study are:

H_0 : $\mu_1 = \mu_2$ [There is no significance different between two groups]

H_1: $\mu_1 \neq \mu_2$ [There is significance different between two groups]

Where, μ_1 and μ_2 are the mean achievement of students taught by using experimental verification and taught by using traditional method respectively.

Delimitation of the Study

This study has the following limitations:

- The research was limited only on the students of grade VIII in government school of Syangja district
- The experimental period of this research will be of to 2 weeks.
- Students' score in achievement test will be obtained from achievement test made by the researcher.
- In experimental period the chapter 'area of triangle and quadrilaterals' and 'polygon' were taught.

Definition of the Term

- **Achievement** : The word achievement in this study is defined in term of the magnitude of score obtained by the students in mathematics
- **Theorem :** A mathematical properties that can be proved by reasoning
- **Experimental verification:** It is a way to clarify the theme of statement and checking the statement whether it is true or not, using three figures and their actual measure is consider as an experimental verification.
- **Theoretical proof:** The deductive proof of the theorem using the definition, axioms, postulates and previously established theorem to reach the conclusion.
- **Experimental group:** The group of students taught through using the treatment experimental verification.
- **Control group:** The group of students taught without using the treatment.

Chapter II

REVIEW OF RELATED LITERATURE

Empirical Literature

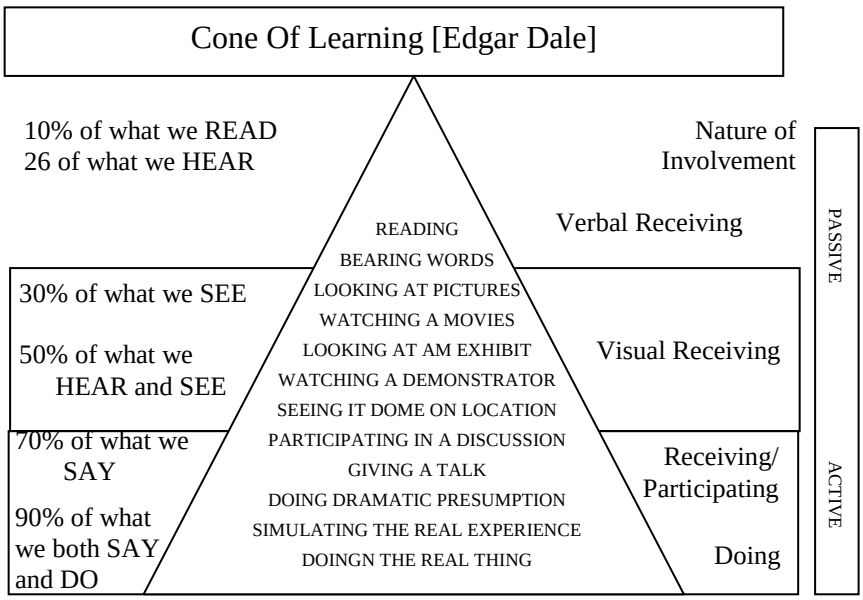
Literature review is the study of the researches done by other people closely related to the researchers topic of the study. The aim of literature review is to frame their ideas and provides the benchmark for comparing the finding of the different study and differentiate their study from the previous one. Further more, the review of literature provides the ground for their study, framing their conceptual framework and finding the theories related to their studies. It provides theoretical framework for the researcher as well as appropriate logical framework.

The related studies and literatures provide basic information, which is essential to the present study. It helps to conduct the new research in a systematic manner by providing the general outline of the research study and avoids the unnecessary duplication. The review of related literature involves the systematic identification and analysis of documents related to the study was undertaken. Scientific research is based on past knowledge. The previous studies cannot be ignored because they provide the foundation to the present study. The following empirical researches were reviewed in this study:

Adan (2010) did a research on the topic "The experimental teaching in some of topics geometry". The aim of this study is to compare the experimental teaching method (ETM) with the teacher centred traditional teaching method on students' success. This study has conducted with 54 students, randomly divided into two groups; an experimental group and a control group. Experimental teaching method was used for the experimental group and traditional teaching method was used for control group. The test was applied to both groups in two different times. The first test was applied before the treatment and the second test was applied after the experiment. The score of the students was compared by applying t-test at 0.05 level of significance. According to the research results, it was found that experimental teaching method was more effective than teacher-centred traditional teaching method in the knowledge and comprehension level.

Bhusal (2000) did a research in the topic "A Study on the Effectiveness of Teaching Geometry using Discovery method and Expository method of teaching in lower secondary level" with the research hypothesis 'the mean achievement of the group of students taught through the discovery method is higher than the mean achievement of the group of students teaching through the expository method between the 48 students of two different school. He found that discovery method of teaching geometry is far better than the expository method.

Dales (1969) researches shown that students that have learning experience through active learning do better compared to those students in a traditionally-taught classroom. There has been an increasing emphasis on the use of active learning in Mathematics classes. When using active learning, students are engaged in more activities than just listening. They are involved in dialog, debate, writing, and problem solving, as well as higher-order thinking, Bonwell states that "in the context of the college classroom, active learning involves students in doing things and thinking about the things they are doing" (Bonwell; 2003). According to Dale's research, the least effective method at the top of cone, involves learning from information presented through verbal symbols, i.e., listening to spoken word-lectures, while the most effective methods at the bottom of cone involves the student active participation in learning activities.



Edgar Dala, Audio Visual/Motchok in Technology Holt,

Dale's cone of learning through participation (Dale, 1969)

This view is supported later by other researchers like Stice (1987). According to Stice students retain 10% of what they read, 26% of what they hear, 30% of what they see, 50% of what they see and hear, 70% of what they say, and 90% of what they say as they do something. Most mathematicians agree that the best way to learn mathematics is by actively doing mathematics; by discussing it with others; and by synthesizing major ideas (Rosenthal, 1995).

Ghimire (2001) did a research on the topic "A Study on the Impact of Experimental Verification in Teaching the Deductive Proofs of Geometric Theorem" with the aim to the study of effect of prior use of experimental verification in proving the geometric theorem. The study was conducted between 30 ninth grade students of two different schools for 15 days. At the end of the experimentation time an achievement test was conducted and the scores were analyzed by using t-test with 0.05 level of significance. He concluded that there was a good effect of the prior use of experimental verification improving the geometric theorem.

Godfrey and Siddons (1910) had written an article on the topic "Experimenta1 Task and Geometrical Eye", which can summaries as: The important question is why the disconnection between experiment and deductive geometry would be inappropriate in the teaching of geometry? Godfrey considered that mathematics would not be undertaken by only logic. He wrote that another important 'power' would be necessary for solving mathematical problems, i.e. 'Geometrical power', which was 'the power we exercise when we solve a problem'. To develop this 'geometrical power', it would be essential to train students 'geometrical eye', which was 'the power of seeing geometrical properties detach themselves from a figure'. When we reflect on solving geometrical problems, Godfrey's view is quite right. Let us consider an example if A, B are the mid-points of the equal sides XY, XZ of an isosceles triangle XYZ, prove that AZ=BY'. When we consider this problem, we would not be able to prove this statement unless we can 'see' that; for example, triangle AYZ and triangle BZY are likely to be congruent first of all. Godfrey stated that this kind of 'power' would be essential to solve geometrical problems, and it was experimental tasks that would make possible to train 'geometrical eye' at any stages in geometry.

Gwynn (1961) had written a book on the title "Theory and Practices of

Supervision" and gave some suggestion for experimentation as follows:

- The new method that is tried out should be judged to be good one.
- Effective than the old method which should not harm the pupils or hinder his learning
- Both children and teacher should be aware of experimentation. And their co-operation should be secured.
- The teacher should not be blamed if the experiment is not successful as we hoped.

K.C. (2005) did a research on the topic "attitude of lower secondary level students towards the role of experimental verification for the theoretical proofs in geometry". The sample of this study contained 128 tenth grader from different four schools as the instrument, opinionnaire was used to collect the attitude of students. The set of opinionnaire contained 28 statements, supporting to the role of experimental verification for the theoretical proof in geometry. For the analysis chi-square test with 0.05 level of significance was applied. He concluded that the students have positive attitudes towards the experimental verification for the theoretical proof in geometry.

Pandit (1999) did a research on the topic "A study of attitude of lower secondary level students and teacher towards geometry". He concluded that positive attitude of secondary students was found towards the geometry. He further concluded that teacher had negative attitudes towards geometry at lower secondary level. He also stated that boys had better attitudes than girls. The mean attitudes scores of the students were significantly greater than that of their teachers.

Tamsim (1998) have written an article on the topic "What makes a good mathematical problem?" and he concluded with few lines as: potentially good problems have multiple entry and exit points which can have several right answers blending of different mathematical ideas, linkages to problems in other situations, and communication as an important part of problem solving.

From the above researches we can concluded that experimental verification of

geometric theorem is effective tool to know about what the statement says and its reality and we further conclude that knowledge from their own experimental verification will be the knowledge for long. The main theme of the experimental verification of the statement is familiar to the students with the mathematical instrument irrelevant with the statements. It helps to make deep understand and to express themselves for the statements which may not be done by the traditional method of teaching geometry So most of the reviewed researches have the same sense that the experimental verification is better than the traditional method.

Theoretical Literature

Many theories about the learning and development of children such as cognitive, behaviourist, humanist, socio-culture of which is one of the theories to analyze and interpret the data of mathematics or resolve the problem. To analyze and find the suitable solution in the area of low participation and achievement in mathematics; socio-culture one of the possible theory to solve the problem of the topic of "achievement and participation in mathematics of Tharu students. Every child learns from society, from social contact with home, family and universe.

According to Cobb (2007), theoretical contributions in the field of mathematics education have come primarily from four traditions: experimental psychology, cognitive psychology, distributed cognition, and socio-cultural theory. This study draws primarily on socio-cultural theories of learning because of its explicit emphasis on theoretical assumptions regarding social and cognitive development that hinges on participation in cultural practices (e.g., language socialization through participation in classroom discourse, or understanding of mathematics from informal, out-of-classroom experiences, etc.). Moreover, data collection and analysis focused on the processes by which students became participants in various roles and to various extents in mathematics discourse related to rational number tasks.

Socio-cultural theories of mathematics learning are generally associated with the seminal work of Vygotsky (1978) and prioritize the socially and culturally situated nature of mathematical activity over individual sensory-motor functions (Cobb, 1994). Vygotsky (1978) identify three general themes fundamental to his theory of

development: (a) Higher mental human processes can be best understood by focusing on how and when they occur; (b) higher mental processes, such as memory, concepts, and reasoning, originate between people on the social plane before appearing in the individual on the psychological plane; and (c) higher mental processes are mediated by cultural tools and signs such as language, writing, and symbols.

Vygotsky claimed that all higher mental activity originates through a process of internalization, or what some scholars refer to as "appropriation" (Cazden, 2001), which he described as the process by which individuals engage in cultural practices on the inter mental plane (i.e., through social interaction) before gradually performing these practices independently on the intra mental plane (i.e., through internalization). The transformation between the social and psychological planes occurs within a zone of proximal development the space between an individual's independent capabilities and his or her immediate mental potential. In other words, the zone of proximal development is determined by both the child's level of development and the quality of instruction provided to the child (Wertsch, 1985). It is in this space that social interaction between a novices and more knowledgeable others can lead to internalization of higher mental functions. Vygotskian learning theory, and in particular, his contributions regarding the zone of proximal development, essentially paved the foundation for cooperative learning as a viable instructional approach in modern classroom settings (Schunk, 1996).

Other researchers have extrapolated Vygotsky's work into theories that rely on an apprenticeship metaphor (e.g., Lave and Wenger, 1991; Rogoff, 1990), specifically stating that learning occurs in social interaction between novices and more-skilled others through increasingly grater degrees of legitimate participation (Lave and Wenger, 1991). In other words, learning is defined, in part, as a positive change in participation in a set of cultural practices. For example, while co-participating in mathematics discourse communities, teachers or more-able peers initially take a major role in sharing their reasoning aloud.

Conceptual Framework

A conceptual framework is made to find out the experimental approach at lower secondary level in mathematics learning. According to this approach research

would follow the following steps for experimental verification method.

1. Planning, Developing and Organizing Instruction

One of the most important parts of teaching takes place long before the teacher begins any lesson, planning, organizing and developing instruction are the major parts of any teachers job. If a teacher is effective at planning their lessons they will find that their day to day teaching task is much easier for this steps researcher has presented the teaching lesson and teaching materials.

2. Presenting Subject Materials

After observing the behaviour and foundation of students the researcher related their pre knowledge with the new knowledge and introduce the subject materials.

3. Managing Students Conduct

In this steps teacher manages the student activities curiosity knowledge and their interaction. Teacher also creates an effective classroom management policy.

4. Assuring Student Learning

All instruction should be built around assessment when a teacher sits down to develop a lesson, they should began by deeming how they will major whether the students learn what they trying to teach. While the instruction is the meet of the course, the assessment is the major of success for this researcher try to evaluate students asking different types of questions related to topic and assures the level of achievement.

Chapter- III

METHODOLOGY

Methodology is a bridge to achieve the object of the study in systematic way. It describes the method and process applied to the entire aspect of the study. In other words, methodology is the way to gather information we must have population of the study for the designing of methodology. Representative group should select for the true experiment. Thus the framework of methodology contains research design, population sample tools, data collection procedure and data analysis procedures.

Research Design

Research design is the design of path about how the research was conduct. To fulfil the objectives of this research, two group of students were form different two school known as experimental and control group. The experimental group of students was taught regularly using experimental verification method. But the control group of students was taught regularly without experimental verification method. At the end of the experimentation time an achievement test was conduct to both group and their scores were compare and also the information for observation was analysed. So it is known as the pre-test and post-test equivalent group. Both the quantitative and qualitative techniques were apply to analyse the data. The following table can shows the design of this study as follows:

Table No. 1

Research Design

Group	Pre-test	Treatment	Post-test
Experimental	P_E	VIII	T_E
Control	P_C		T_C

Where, VIII = Treatment

P_E = Pre-test given to experimental group

P_C = Pre-test given to control group

T_E = Post-test given to experimental group

T_C = Post-test given to control group

Population of the Study

The population of the study were the government school students of grade VIII from Syangja district. Two school are selected Shree Purnamrit Bhawani Secondary School, Walling - 10, Fulbari, Syangja and Shree Kotakot Basic Level School, Kaligandaki - 3, Syangja district.

Sample of the Study

Two government schools named as Shree Purnamrit Bhawani Secondary School, Walling - 10, Fulbari, Syangja and Shree Kotakot Basic Level School, Kaligandaki - 3, Syangja district was selected by convenience sampling method. Twenty students from each school was select by using simple random method and were known as experimental and control group, which was determine by sampling method. The group of 20 students of Shree Purnamrit Bhawani Secondary School, Walling - 10, Fulbari, Syangja was selected for experimental class and the group 20 students of Shree Kotakot Basic Level School, Kaligandaki - 3, Syangja district was selected for control group for sampling method. Selection of the students was as follows in both groups.

Table No. 2

Sample of the Study

Division of Students	Number Students in Sample
Distinction	1
First Division	5
Second Division	8
Third Division	4
Failure	2
Total	20

The score of students was taken from the pre-test result. Random sampling

was done between the students of respected group as their division.

Variable

- **Independent variable :** In this study experimental verification of the geometric theories is known as independent variable.
- **Dependent variable :** In this study student's achievement are participation on learning interaction attendance rate, homework and class work known as dependent variable.
- **Controlling extraneous variable :** Since this study was examined to find effectiveness of experimental verification in teaching mathematics of grade VIII students. It detected and nullified the effect of other variable besides the experimental variable, which might influence the achievement. Certain extraneous variables cannot be control directly. Some of the variables history maturation, testing and mortality were controlled by the design of the experiment. The following exercise were done to control the variables.
- In both of the experimental and control group taught the same content and took same test.
- Both groups were selected by randomization.

Some Major Affecting Variable Controlled in the Experiment

- **Selection of School:** Such two schools were selected in sample which is similar in socio-economic status, facilities and result of students.
- **Teacher:** Researcher himself was taught for the control and experimental group.
- **Students:** Students having the age betweens 13-18 and not having the regular extra class (tuition) of mathematics was selected in the sample.
- **Subject matter:** In experimental period the chapter ‘triangle and quadrilaterals’ and ‘regular polygon’ was taught for the both group.
- **Equivalence of the groups:** Experimental and control group of students was made comparable using their score on the pre-test, as mentioned above.

- **Length of the Experiment:** Researcher had provided equal time duration (2 weeks) to teach both experimental and control group.
- **Test:** Same test paper was conducted for the both group after the time of experimentation.
- **Scoring:** Researcher himself give the score of students in text paper appeared by the students of both group.
- **Module:** To conduct the experiment, the researcher was developed a daily teaching module for the unit Geometry from grade VIII Mathematics curriculum.

Some Uncontrollable Affecting Variable in the Experiment

- **Student's labour:** Students may labour more or less than expected by the researcher and self-study of the students may affect in the result of research which is out of control.
- **Student's home environment:** Student's home environment has great effect on student's behaviour and attitude but it cannot be controlled by the researcher.

Experimentation Process

After making the groups comparable from the result of pre test, researcher himself was taught for the control and experimental group regularly for 2 weeks. The experimental group of student was taught through using experimental verification of the statement but the control group students was taught by traditional method. Experimental group was taught before to start the school (at 9 am) and control group was taught after finishing the school (at 4:30 pm). The experimental process 12 lesson plans for the experimental group is based on the manipulation of the mathematical instruments which were decided as the following parts: Specific Objectives, Teaching Materials, Teaching Learning Activities, Conclusion, Evaluation and Homework. And also the observation of the students in both groups was done regularly for the time of experimentation.

Tools

At the end of the experimental time an achievement test was prepared by the researcher himself including 30 subjective questions from the chapter 'triangle and quadrilaterals and regular polygon' which were taught by the researcher in the experimental time, where each subjective question was of the weight 1 mark, 2 marks and 4 marks. Daily observation note including the student's activities of both experimental and control group were recorded which was known as the tools for the research.

Validation and Reliability of the Tools

Validation of the tools was established by the helps of subject teacher. Reliability of the test was checked by the test-retest method between 20 same grader students from a school not in sample. By the calculating of coefficient correlation the reliability of the test was determined which was 0.96 (shown in Appendix D). It indicates that the achievement test was highly reliable.

Data Collection Procedure

For the collection of data the researcher was taught two school. The experimental group of students was taught regularly for 2 week by using experimental verification on the statements and the control group of students was taught regular for the same time using theoretically. At the end of the experimentation time an achievement test was conduct to both groups and their scores was record. And prepare observation note which are known as the data of research. And the information about the students' activities in daily class were observed and prepared observation note which are known as the data of research. The behaviour of students of both groups about participation on learning, interaction, attendance rate, home work and class work and regularity of the students etc. was categories and the information obtained by students in the time of experiment was recorded and coded separately on the observation note by the researcher him self.

Data Analysis Procedure

Meaningful information is possible only after the good analysis of the data. Being a quantitative research, statistical data analysis procedures was apply for the

analysis of the data. First the mean, standard deviation and variance were calculate from the achievements of both group, t-test was apply with $N_1 + N_2 - 2$ degree of freedom and 0.05 level of significance in two tail.

Interpretation of correlation coefficient

Coefficient	Relationship
0.00 to 0.20	Negligible
0.20 to 0.40	Low
0.40 to 0.60	Moderate
0.60 to 0.80	Substantial
0.80 to 1.00	High very high

Source : Best J.W. and Kahn J.V.P. 308.

Chapter IV

ANALYSIS AND INTERPRETATION OF THE DATA

This chapter deals with the analysis and interpretation of data. An experimental research was done in concern to the topic "Effectiveness of experimental verification in teaching geometry at lower secondary level". The objectives of the study were 'to compare the achievements of the students taught by using experimental verification method and traditional method in geometry' and 'to analyze the effect of experimental verification in learning mathematics'. A pre-test post-test equivalent group design was adopted for the purpose of the study. A pre-test was taken to make the groups comparable. Primarily, the mean score of the students in post test was taken to fulfil the first objective of the study. And for the second objective of the study, an observation note was used. The score of the students were analyzed using the statistical method of analysis and the qualitative data about the behaviour of the students while using experimental verification were analyzed descriptively. Thus, this section of the study can be divided into following two parts:

Comparison of the Mean Achievement Scores of Experimental and Control Groups on Pre-test

To make the group comparable pre- test was adopted among the students of both experimental and control group from the related content area. The score obtained by the students of both groups in pre-test have been given in Appendix C. The mean, variance, standard deviation and t-test was applied and summarized m the following table:

Table No 3

Comparison of Pre-test score between Experimental and Control Group

Groups size	Sample	Mean	Standard Deviation	Variance	Calculated t-value	tabulated t-value	Decision
Experimental	20	13.1	5.06	25.6	0.14	1.96	No significant difference
Control	20	13.15	4.84	23.42			

From the above mentioned table it is clear that the mean, standard deviation

and variance of experimental group were 13.1, 5.06 and 25.6 respectively whereas, the mean, standard deviation and variance of control group were 13.15, 4.84 and 23.42 respectively, which shows that the mean between these two groups seems nearly to be equal. But to know whether the difference between means was significant or not, t-test was used at 0.05 Level of significance with 38 degree of freedom. The calculated t-value was 0.14 which was less than the tabulated value of t = 1.96. This leads us to decide that there is no significant difference between the mean scores of experimental and control group. It means that these two groups were comparable. Hence the change in result at post test will be the cause of treatment.

Comparison of the Mean Achievement Scores of Experimental and Control Groups on Post-test

The score obtained by the students of both groups in post-test were given in Appendix C. The mean, variance, standard deviation and t-test analysis were summarized in the following table:

Table No 4

Comparison of Post-test score between Experimental and Control Group

Groups size	Sample	Mean	Standard Deviation	Variance	Calculated t-value	tabulated t-value	Decision
Experimental	20	18.1	5.98	35.76	2.37	1.96	No significant difference
Control	20	12.7	8.25	68.06			

The above table shows that the mean, standard deviation and variance of experimental group are 18.1, 5.98 and35.76 respectively. Where as, the mean, standard deviation and variance of control group are 12.7, 8.25 and 68.06 respectively. The calculated t-value 2.37 was greater than the tabulated value of t i.e. t = 1.96. This leads us to conclude that there is significant difference between the mean achievement of experimental and control groups, where, the mean score of experimental group 18.1 was greater than that the mean score of control group 12.7. It means such difference in the result of post-test was caused by treatment used in experimentation.

Qualitative Analysis

The research on the topic “Effectiveness of experimental verification in

teaching geometry at lower secondary level" has been done with the objectives 'to compare the achievements of the students taught by using experimental verification method and traditional method in geometry' and 'to analyze the effect of experimental verification in learning mathematics'. For the fulfilment of second objective it was necessary to observe the behaviour of the students in the classroom teaching by using the experimental verification and traditional method.

Qualitative analysis was done with the help of the information collected through daily classroom observation. Observation is such kind of tools of qualitative analysis which helps to seek information and knowledge through the use of sense organs. Researcher himself noted the behaviour of students after the completion of instructional activities. He used a diary to record the student's participation on learning, interaction, attendance rate home work and class work and regularity of the students etc.

Before Experimentation

Before experimentation, the researcher taught only the experimental group for 5 days without using experimental verification. It was founded that only the high achiever participated for seeking the right answer of the question. Almost students were seems inactive to learn mathematics, they often made noise in the classroom while the researcher taught. A few students performed class work and homework properly. From the subject teacher, the researcher found that attendance rate of the students was low.

After Experimentation

The researcher observed the students activities and behaviours on his 3 weeks classroom instruction, which were noted daily on his diary after the completion of instructional activities. It was found that almost the students of experimental group were more excited while using the experimental verification on teaching mathematics. There was the feeling of competition among the students of experimental group for answering teacher's question. All the students including even the failure to distinction holder were equally participated for seeking the right answer of the questions. They became individually active for seeking of the answer because of the fear of being second than others while interacting with each other. Especially, experimental

verification has crucial role to improve the ability of weak students. The students become more excited and happy by entering the teacher into the classroom. Although having a little bit noise in classroom at the time of distribution of tangible experimental verification, overall class was interesting and competitive. Most of the students of experimental group were presented regularly in the classroom. They executed their homework and class work properly.

Motivation

Motivation is the potential to direct behave out built into the system that controls emotion. This potential may be manifested in cognitive and behaviour. Motivation is considered as the potential to direct ordering to the definition, students motivations may be manifested in cognation, emotion and behaviour. Needs are specified instances of the potential to the direct behaviour. During observation of the class activities these thins were considered and noted in a notebook.

Participation

Observation is a kind of tools that help to seek knowledge through the use offence of eyes, ears nose tongue and skin.

It has great importance not only in research work but also in our daily lives. K.C. (2000) writes that direct observation has the advantage of putting researchers into first hand contact with reality participant observation is the close and full.

Involvement of researchers in a natural setting in order to experience and understand the behaviour interaction event and soon. To get required information the researcher observed overall as well as key respondents individually and collectively during their work at school, classroom, playing with peers, interacting with teacher about 3 weeks.

Regularity

Regularity means students always come to study in school in experimental group. The researcher always wrote daily notes, daily attendance and check the daily homework of the students. Based on these observation, the regularity were checked.

Research Daily Notes

Researcher noted remarkable event found in the class of experimented groups. During experimental period, student's motivation in learning regularity in classroom daily.

Homework and participation in learning and student's discipline in learning activities were noted in researcher daily note. In experimental, the teacher wrote daily note. Researcher gave homework to students daily in class room.

Moreover, the students were seen to be more interested and engaged in teaching learning activities. At the period of experiment the students of experimental group were much satisfied by the teaching compare to the students of control group. The most important factor to apply the experimental group is the time management and the class size. The numbers of students is comparatively higher to provide/project problem to solve in group and the available time is short in the present system of routine given. Only a good train and well knowledge teacher could apply the mathematics teacher and subjects' exports to get the effectiveness of experimental approach and their positive attitude towards the experimental approach an indicated that the experimental is more effective than the traditional method.

According as the information obtained by the regular class observation note to record the student's participation on learning, interaction, attendance rate, homework and class work. Students of experimental group frequently asked questions not only in the classroom but even in out of the classroom while they met to the teacher. The girl students of experimental group were also participated more than the girl students of control group. They gave the answer of the question asked by the teacher without any fear. In summary, most of the students of experimental group were very active, laborious, concentrative and competitive.

On the other hand, the students of control group were not excited to learn mathematics. They did not take mathematics as an interesting subject; they frequently complained that mathematics is very difficult subject even they used to say 'I cannot do well in mathematics' There was vast difference in talent and weak students. Only the talent students participated in the classroom activities. They often sat on the front row of the classroom but the weak students rarely participated in classroom activities

they often sat on the last row. They did not execute their home work and class work regularly. The attendance rate of control group was lower than experimental group. Most of the students in Control group were passive in learning activities so the teacher has to do more exercise in such class rather than students.

In summary, most of the students of control group were inactive, not laborious and not concentrated. Very weak performance of students was observed. The students of control group did not interact with each other and even with teacher. Only very few students of control group were serious for their study.

Behavioural Study of Experimental Group

During the course of several experimental verification taught in the class students were found highly activated and excited. To initiate each experimental verification, I first divided the students into five groups. So that each student could take part in teaching-learning activities enthusiastically. Very weak and weak students also enjoyed in class due to my educational motivation which helped them to trace the concept of that experiment. They were given to draw ‘triangles, quadrilaterals and regular polygon’ having different size. They were found eager to fill up the observational table themselves. The most intersecting thing that they were found so happy when they all drew the same conclusion despite of taking the experiments by considering unequal geometrical figure.

Chapter V

SUMMARY, FINDINGS, CONCLUSION AND RECOMMENDATIONS

This Chapter deals with summary, findings, conclusion and recommendations. The recommendation and suggestions are intended for further study.

Summary

This study was carried out to examine the effect of experimental verification in learning mathematics at lower secondary level. The objectives of this study were: 'to compare the achievement of the students taught by using experimental verification method and traditional method in geometry' and 'to analyze the effect of experimental verification in learning mathematics.' A pre-test post-test equivalent group design was adopted for the study. The population of the study was all the Public School students of grade VIII from Syangja district. The sample schools were selected through the convenience method of sampling which were named as 'Shree Purnamrit Bhawanni Secondary School Walling 10, Fulbari Syangja' and 'Shree Kotakot Basic Level School Kaligandaki - 3, Syangja'. Two comparable groups were formed on the basis of the pre-test result. Each group of students contained 20 students. The t-test analysis was used to ascertain the difference between two groups, which concluded that there was no significant difference between the mean achievements of two groups.

In the time of experimentation, researcher himself taught for 2 weeks to both groups. The teaching learning activities of classroom were based on the Teaching Module developed. The researcher taught the chapters; 'The Area of Triangles, Quadrilaterals and regular polygon' to the both groups. And also, the researcher himself kept the information about the student's behaviour throughout the daily classroom observation. After completion of the experimental stage, an achievement test of 30 marks including 30 marks subjective questions was adopted to both groups. Then the scores obtained by the students on post-test was analyzed using t-test at 0.05 level of significance. The difference in mean scores between experimental and control group were found 5.4, which was significantly difference. This leads us to reject the null hypothesis.

Findings

By the analysis of the collected data from the research tools, the following results were obtained as the findings of the study:

- There was no significant difference between the mean scores of experimental and control group students on pre-test.
- It is found that there is significant difference between the mean achievement scores of these groups on the post-test due to the cause of treatment i.e. the mean score of experimental group was higher than that of control group.
- The use of experimental verification is very fruitful for weak students as well.
- Most of students became very competitive, active, concentrative and laborious throughout the use of experimental verification.
- High participation and interaction among students with each other was observed on experimental group in the period of experimentation.

Conclusion

On the basis of the findings which are presented in the previous section, some very significant conclusions can be drawn about the effect of experimental verification in learning mathematics. Experimental verification has a great role to motivate the students for learning mathematics. Experimental verification helps to make the active participation and it can develop the feeling of competition among students which caused for better performance. Although it is necessary to all categories of students; mostly it supports to improve the academic standard of low achiever student. From over all analysis of the collected data, it seems that experimental verification helps to acquire better achievement in mathematics. So it can be concluded that it is better to use experimental verification while teaching geometry in lower secondary level. Also from the experimentation, we can conclude that there is significant difference between the achievement of students taught by using experimental verification and taught by using traditional method.

Recommendations and Suggestions

The following recommendations and suggestions are forwarded for the further

researches:

- It is recommended that to do the similar study on other level of school.
- It also recommends to study about the relationship between attitudes of mathematics teachers towards using experimental verification method of teaching geometry.
- Same type of research can be conducted in government schools as well.
- To study on ‘how does experimental verification affect students’ achievement, attitude and retention towards mathematics learning?

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Appendix A

Teaching Module

Class: VIII Time: 45

Subject: Maths

Topic: Angles

Specific Objects: At the end of this lesson students will be able to:

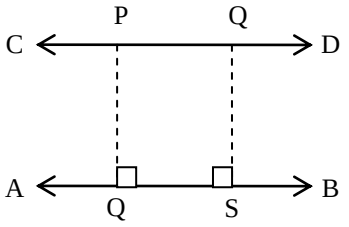
1. Define Alternative angles
2. Define co-interior angles

Teaching Materials: Ruler set square, pencil, etc.

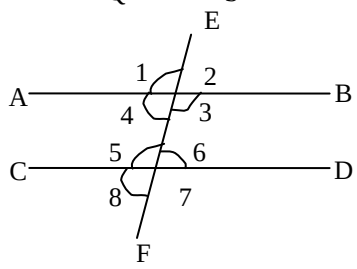
Teaching Learning Activities

The following activities will be held in classroom.

Step 1: Discussion on parallel lines and transversal.



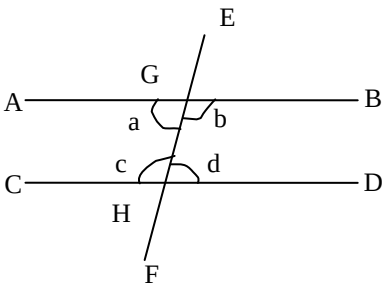
Two line segments are said to be parallel if they do not interest each other when they are extended to either directions. In the figure AB and CD are two parallel lines. It is written as AB||CD. The perpendicular distance between two parallel lines are always equal. In the figure, PQ = RS.



In the adjoining figure, straight line segment EF intersects the parallel line segments AB and CD at points G and H respectively. Here EF is called transversal.

∠1, ∠2, ∠3, ∠4, ∠5, ∠6, ∠7, ∠8 are the angles made by the transversal with parallel lines. Here ∠1, ∠2, ∠7, ∠8 are the exterior angles ∠3, ∠4, ∠5, ∠6 are the interior angles.

Step 2



Teacher discusses co-interior angles. In the given figure ∠a and ∠c, ∠b and ∠d are two pairs of co-interior angles. They are the interior angles lying towards the same sides of a transversal.

Step 3

Conclusion "The sum of a pair of co-interior angles made by a traversal with parallel lines is always two right angles (180°).

$\angle a + \angle c = 180°$

$\angle b + \angle d = 180°$

Teaching Module

Class: VIII Time : 45

Subject: Maths

Topic: Angles

Specific Objects: At the end of this lesson the students will be able to :

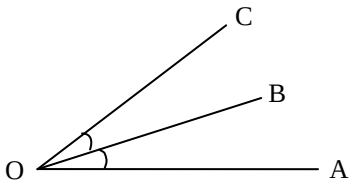
1. Identify pair of angles in linear form.

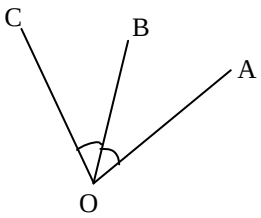
2. Identify pairs of complement angles and supplementary angles.

Teaching Materials: Geo-board, tangram, paper model, pencil set square, and scales.

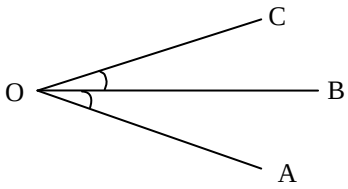
Teaching Learning Activities

Step 1: The following activities will be held in the classroom the teacher presents the pair of adjacent angles in different forms.





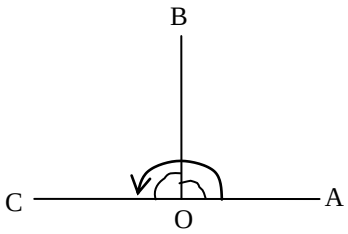
Step 2 : Teacher discusses adjacent angles and linear pair.



∠AOB and ∠BOC are a pair of adjacent angles. They have a common vertex O and a common arm OB.

Liner Pair: If the sum of a pair adjacent angles is 180° they are side to be linear pair. In the figures along side ∠AOB + ∠BOC = 180°

So, ∠AOB and∠BOC are the linear pair.



Step 3: Also, the teacher discusses complementary angles and supplementary angles.

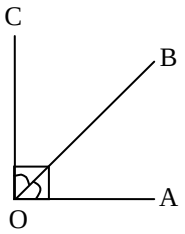
Complementary Angles

A pair of angles are said to be commentary if their sum is a right angle (90°). In the figure ∠AOB and ∠BOC are a pair of complementary angles.

∠AOB + ∠BOC = 90°

Also Complement of ∠AOB = 90° - ∠BOC

Complement of ∠BOC = 90° - ∠AOB



Supplement Angles

A pair of angles are said to be supplementary if their sum is two right angles (180°). In the figure, ∠AOB and ∠BOC are pair of supplementary angels.

∠AOB + ∠BOC = 180°

Also, the supplement of ∠AOB = 180° - ∠BOC

The supplement of ∠BOC = 180° - ∠AOB

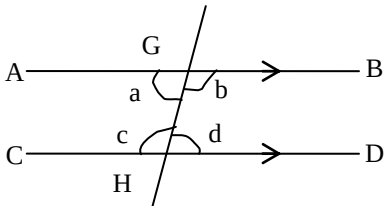
Homework

1. If 2p° and (p + 15)° are a pair of complementary angles find them.

2. If x° and $\frac{x°}{4}$ are a pair of supplementary angles find them.

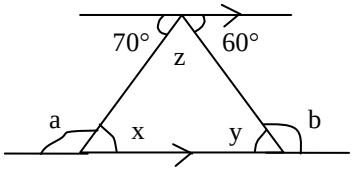
Step 4: Teacher discuss alternate angles.

In the given figure ∠a and ∠d, ∠b and ∠c are two pairs of alternative angles. They are the interior angles adjacent to each other and lying towards the alternate sides of the transversal.



Step 5: Also, the teacher conclusion that the alternative angles made by a transversal with parallel lines are always equal.

Homework



Find the sizes of unknown angles in the above figure.

Teaching Module

Class: VIII Time: 45 min.

Subject: Maths Date: …….

Topic: Triangle

1. **Specific objects:** At the end of this lesson, the students will be able to verify experimentally that "If two sides of a triangle are equal, then the angles opposite to them also equal or the base angles of an isosceles triangle are equal."

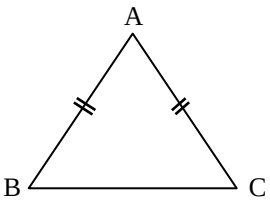
2. **Teaching materials:** Geo-board, tangram, paper model of isosceles triangle, pencil and ruler.

3. **Teaching learning activities.** The following activities will be held in classroom.

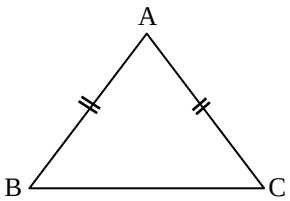
   Step 1: Discussion on different types of triangles according to sides and angles.

   Step 2: They will be made draw isosceles triangle ABC.

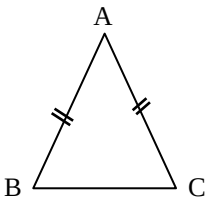
   Step 3: They will be made draw those isosceles triangles ABC in which AB = AC with different shapes and sizes.



(i)



(ii)



(iii)

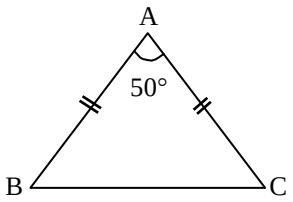
Step 4: Students are encouraged to fill this table and find the conclusion from their own experience (Measure ∠B and ∠C with the help of protractor and tabulate them as follows.

Fig.	∠B	∠C	Results
i			∠B = ∠C
ii			∠B = ∠C
iii			∠B = ∠C

Conclusion: Students will be reached at the conclusion that the base angles of an isosceles triangle are equal.

Evaluation:

In the given figure ABC is a triangle in which AB = AC, ∠A = 50°, find ∠B.

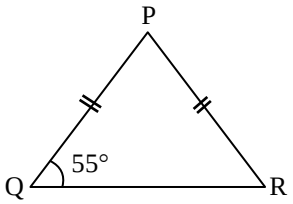


Homework:

In the given figure, ABC is a triangle which in PQ = PR,

∠P = 55°.

Find ∠Q.



Teaching Module

Class: VIII Time: 45

Subject: Maths

Topic: Triangle

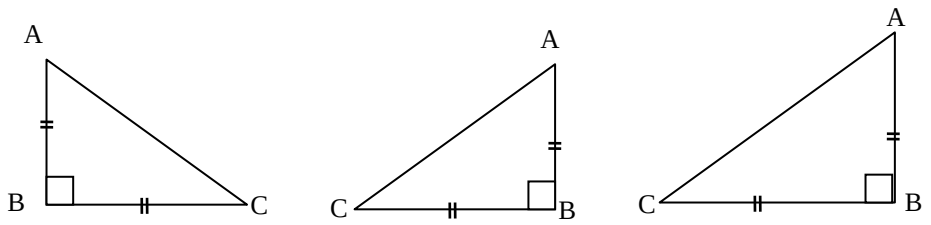
1. Specific objects: At the end of this lesson, students will be able to verify experimentally that. "Each of the base angles of an isosceles right angled triangle is 45°."

2. Teaching materials: Geo-board, tangram paper model of triangle, pencil, set square ruler.

3. Teaching learning activities. The following activities will be held in classroom.

   Step 1: Teacher presents different shapes and sizes of triangle.

   Step 2: They will be made three right angled triangle ABC in which AB = BC with different shapes and sizes with the help of ruler and pencil.

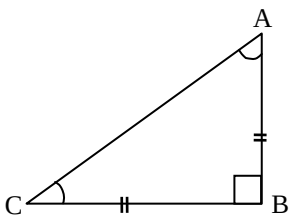


   Step 3: They will be encouraged to fill the following table from the figures with their actual measurement themselves by using measure ∠A and ∠C. with the help of protractor and tabulate them.

Fig.	∠A	∠C	Results
i			∠A = ∠C = 45°
ii			∠A = ∠C = 45°
iii			∠A = ∠C = 45°

   Conclusion: Hence the base angles of an isosceles right angled triangle is 45°.

4. Evaluation: In the given figure ABC is a right angled triangle find ∠A.



   Homework: In the given figure, ABC is a triangle in which AB = AC, ∠A = 50°, find ∠B.

Teaching Module

Class: VIII Time: 45

Subject: Maths

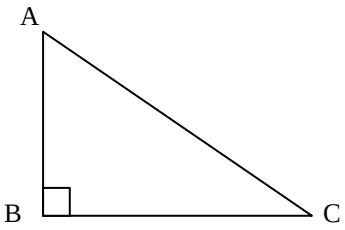
Topic: Pythagoras Theorem

1. Specific objects: At the end of this class, students will be able to verify experimentally that. "The square of the hypotenuse of right angled triangle is equal to the sum of the squares of perpendicular and base."

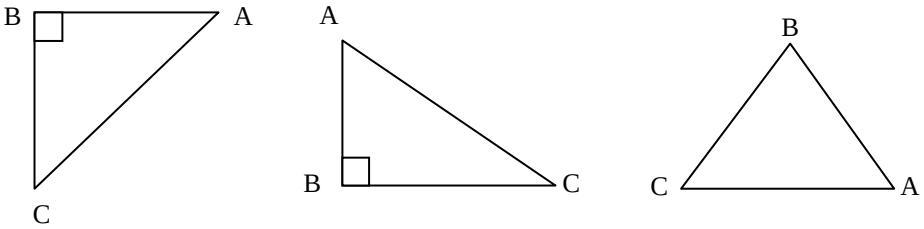
2. Teaching materials: Geo-board, tangram, paper model of right angled triangle, pencil, scale.

3. Teaching learning activities. The following activities will be held in classroom.

Step 1: Student will be mentioned to draw right angled triangle.



Step 2: Draw three right angled triangle ABC with different shapes and sizes and right angled at B as shown in figures.

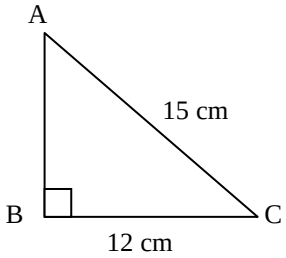


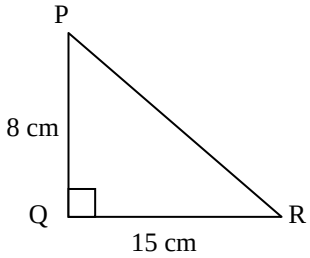
Step 3: They will be encouraged to fill the following table from the figures with their actual measurement themselves.

Fig.	AB	BC	CA	AB^2	BC^2	CA^2	$AB^2+ BC^2$	Results
i								$AC^2= AB^2+ BC^2$
ii								$AC^2= AB^2+ BC^2$
iii								$AC^2= AB^2+ BC^2$

Conclusion: Students will be reached at the conclusion that the square of the hypotenuse of a right angled triangle is equal to the sum of the square of perpendicular and base.

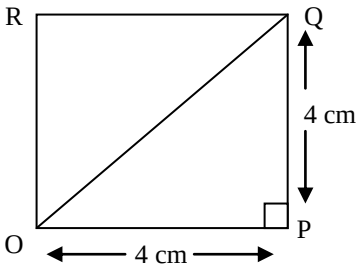
4. Evaluation: Calculate the length of unknown side in each of the following right angled triangle.



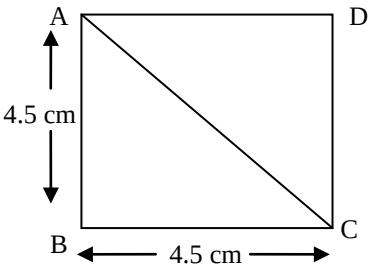


Homework: Find the length of the diagonal in the following squares.

a)



b)



Teaching Module

Class: VIII Time: 45 min.

Subject: Maths Date: …….

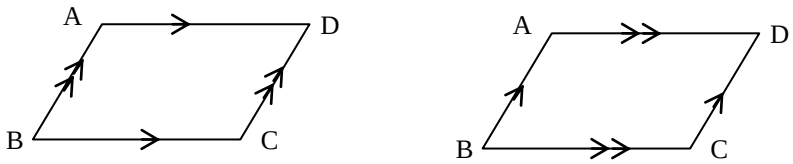
Topic: Parallelogram

Specific objects: At the end of this lesson, students will be able to verify experimentally that. "The opposite angles of a parallelogram are equal."

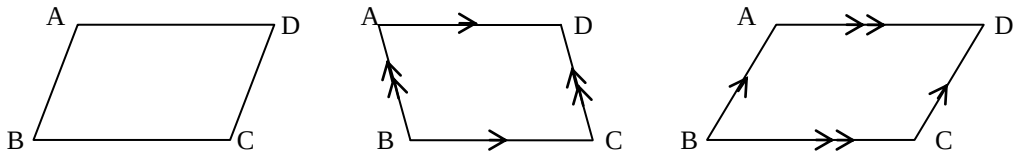
Teaching materials: Geo-board, tangram, paper model, pencil, set square, and ruler.

Teaching learning activities. The following activities will be held in classroom.

Step 1: Teacher presents different size and different angles of parallelogram.



Step 2: They will be made three parallelograms ABCD where AB||CD and AD||BC with different shapes and with the help of a set square and ruler.



Step 3: To identify, ∠A = ∠ C and ∠D = ∠B. Discuss.

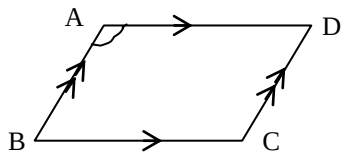
Step 4: They will be encouraged to fill the following table from the figure with their actual measurement themselves.

Fig.	∠A	∠B	∠C	∠D	Results
i					∠A = ∠C and ∠D = ∠B
ii					∠A = ∠C and ∠D = ∠B
iii					∠A = ∠C and ∠D = ∠B

Conclusion: Students will be reached at the conclusion that the opposite angles of a parallelogram arc equal

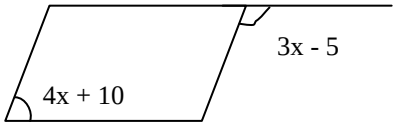
Evaluation: If ∠A = 120° in a parallelogram.

ABCD, then find the remaining angles:

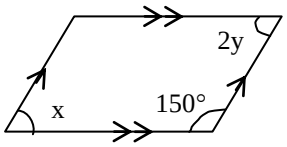


Homework: Find the size of x°, y° etc. in the following figures.

a)



b)



Teaching Module

Class: VIII Time: 45 min.

Subject: Maths Date: …….

Topic: Parallelogram

Specific objects:

At the end of this class, students will be able to verify experimentally that. "The diagonals of a parallelogram, bisect each other."

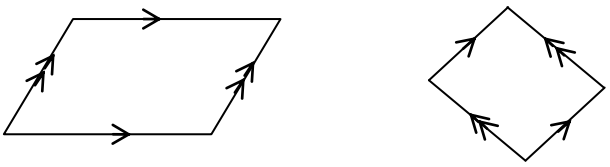
Teaching materials:

Geo-board, tangram, paper model, pencil, set square, scales.

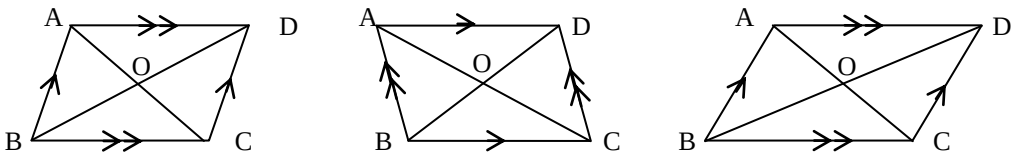
Teaching learning activities.

The following activities will be held in classroom.

Step 1: Teacher presents different size and shapes of parallelogram.



Step 2: They will be made three parallelograms ABCD where AB||CD and AD||BC with different shapes and sizes with the help of set square and ruler in each figure draw diagonals AC and BD which interest each other at O.

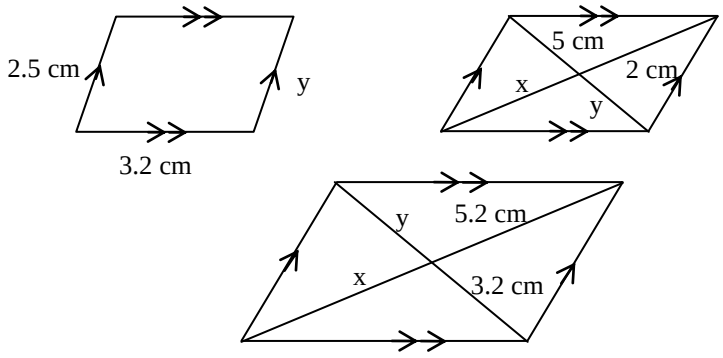


Step 3: They will be encouraged to fill the following table from the figures with their actual measurement themselves.

Fig.	AO	OC	BO	OD	Results
i					AO = OC and BO = OD
ii					AO = OC and BO = OD
iii					AO = OC and BO = OD

Conclusion: Students will be reached at the conclusion that the diagonal of a parallelogram bisect each other.

Evaluation: Find the value of x and y in the following figures.



Homework: Find the value of x and y in the given figures.

Teaching Module

Class: VIII Time: 45 min.

Subject: Maths Date: …….

Topic: Quadrilateral

Sub-Topic: Parallelogram

1. **Specific objects:** At the end of this lesson, students will be able to verify experimentally "The opposite side of a parallelogram are equal."

2. **Teaching materials:** Geo-board, tangram, paper model, set square rules, pencil of a parallel of parallelogram.

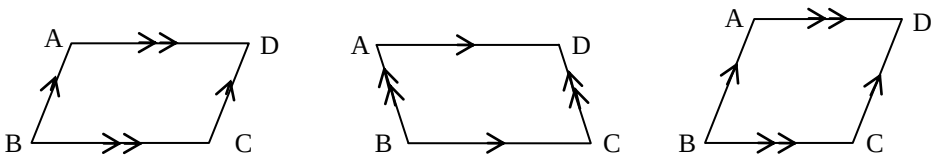
3. **Teaching learning activities.** The following activities will be held in classroom.

   Step 1: Teacher ask the question. Such as;

   - What is a quadrilateral?
   - Type of quadrilateral.
   - Draw a figure.

Step 2: Discussion and interaction of the parallelogram.

Step 3: Draw three parallelograms ABCD where AB||CD and AD||BC with different shapes and sizes with the help of set square and rules.

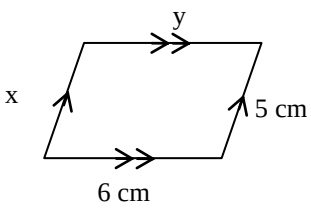


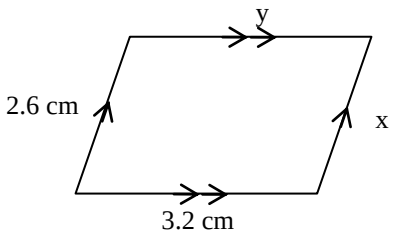
Step 4: They will be encouraged to fill the following table from the figure with their actual measurement themselves.

Fig.	AC	CD	AD	BC	Results
i					AB = CD and AD = BC
ii					AB = CD and AD = BC
iii					AB = CD and AD = BC

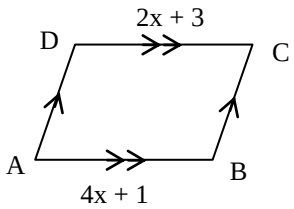
Conclusion: Students will be reached at the conclusion that "The opposite sides of a parallelogram are equal.

Evaluation: Find the value of x, y and their perimeter each of he following figures.





Homework: In the adjoining parallelogram, find AB.



Teaching Module

Class: VIII Time: 45

Subject: Maths Date: ……

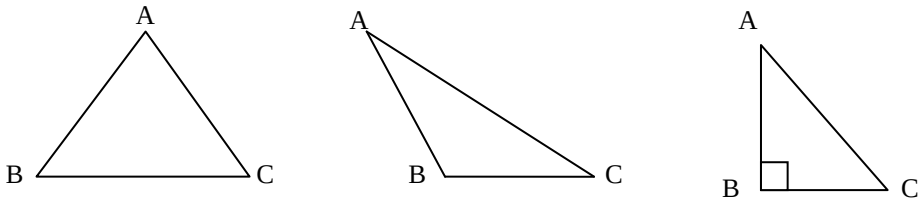
Topic: Triangle

Specific objects: At the end of this lesson students will be able to that. "Experimental Verification of the sum of the angles of triangles.

Teaching materials: Geo-board, tangram, scales and pencil, set square, protractor.

Step I

Teaching learning activities. Draw three triangle ABC with different measurement.



(i) (ii) (iii)

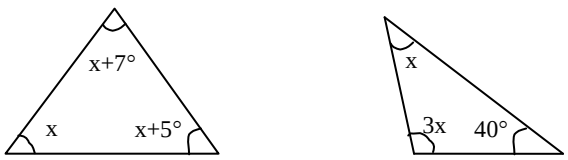
Step 2: They will be made draw the three triangles ABC with different measurements and angles A, B and C with the help of protractor and write the measurement in the table.

Fig.	∠ABC	∠ABC	∠ACB	Results
i				$\angle BAC + \angle ABC + \angle ACB = 180^0$
ii				$\angle BAC + \angle ABC + \angle ACB = 180^0$
iii				$\angle BAC + \angle ABC + \angle ACB = 180^0$

Conclusion: The sum of the angles of a triangle is 180°.

Homework

Find the unknown sizes of angles in the following figures.



Appendix B

Pre-Test

Time: 45

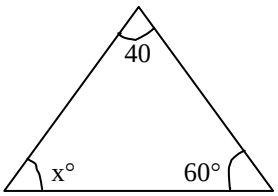
Full: 30

Group A [6×1=6]

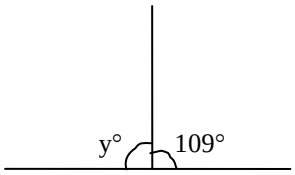
1. a) If y° and 50° form a linear pair, find y°.

   b) If 2p° and (p + 156)° are a pair of complementary angles, find them.

   c) Find x°.



   d) Find y°.



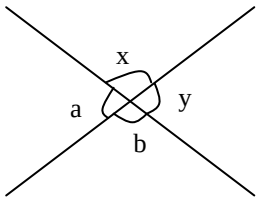
   e) If y° and $\frac{y^0}{5}$ are a pair of supplementary angles, find them.

   f) If a° , 50°,70° and 130° are angles of a quadrilateral then find the value of a°.

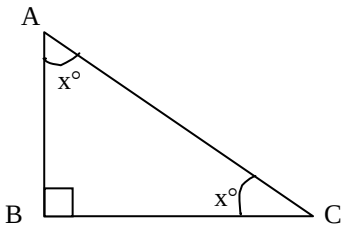
Group B [4×2=8]

2. a) If a pair of complementary angles are in the ratio 4:11, find them.

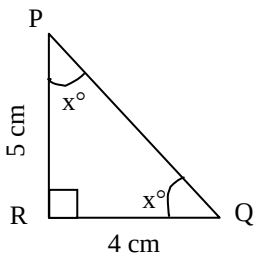
   b) In figure alongside if x = 3y, find the size of angles represented by a and b.



   c) Find the unknowns sizes of angles.



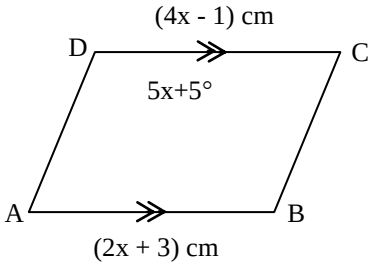
   d) PQ =?



Group C [4×4=16]

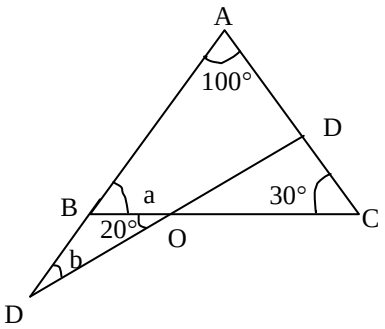
3. a) In the adjoining parallelogram,

find the length of AB.



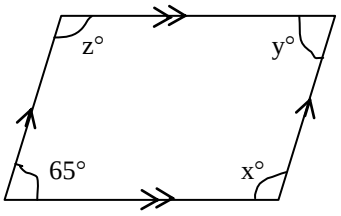
b) Verify experimentally that the angles of a triangle is 180^0.

c) Find the unknown sizes.



d) Calculate the unknown

sizes of angles.



Pre-Test

Time: 45

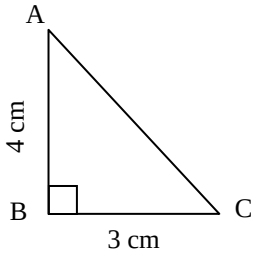
Full: 30

Group A [6×1=6]

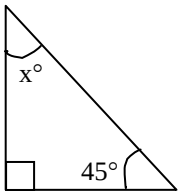
1. a) If x° and 54° form a linear pair find x°.

b) x° and $\frac{x°}{4}$ are a pair of supplementary angles, find them.

c) Find the unknown length of side of the following right angled triangle.



d) Find the unknown size of the angle from the right angled triangles.

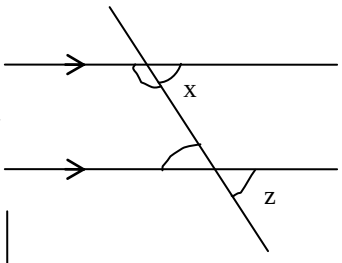


e) Find the sum of interior angles of the regular polygons by using formula. (Quadrilateral)

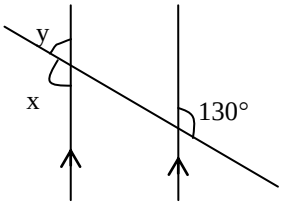
f) If a°and 50° are vertically opposite angles. Find the value of a°.

Group B [4×2=8]

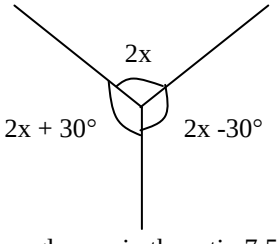
2. a) Find the unknown sizes of angles.



b) Find x° and y°.



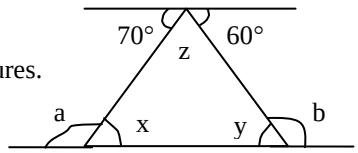
c) Find the unknown size.



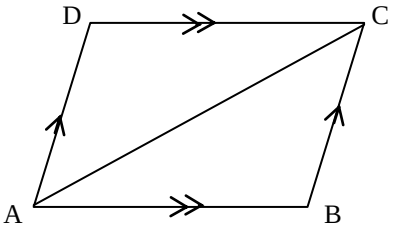
d) If a pair of supplementary angles are in the ratio 7:5, find them.

Group C [4×4=16]

3. a) Find the sizes of unknown angles in the followings figures.



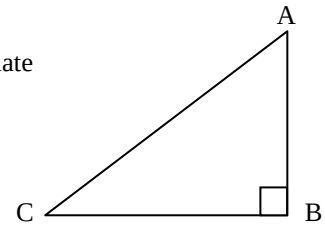
b) In the figure along side AB = CD and AB||DC show that:



i) AD||BC

ii) AD||BC

c) In the adjoining right angled triangle ABC calculate the length of BC.



d) Verify experimentally that the diagonals of a square are equal.

Appendix C

Scores Obtained by Students in Pre-test and Post-test

S.N.	Pre-test (30 marks)		Post-test(30 marks)	
	Experimental Group	Control Group	Experimental Group	Control Group
1	22	24	28	28
2	21	20	26	27
3	19	18	23	26
4	18	18	22	17
5	17	17	26	16
6	17	16	20	13
7	14	14	22	22
8	15	13	16	10
9	13	13	18	13
10	12	12	12	10
11	12	14	21	10
12	12	12	13	21
13	11	12	15	7
14	14	12	24	6
15	12	11	19	5
16	9	11	17	6
17	8	9	13	4
18	8	8	8	6
19	6	5	9	3
20	2	4	10	4
Average	13.1	13.15	18.1	12.7
Standard Deviation	5.06	4.84	5.98	8.25

Appendix D

Marks of Students

S.N.	Marks obtained test (X)	Marks obtained in 2^{nd} test (Y)	XY	X^2	Y^2
1	32	33	1056	1024	1089
2	31	30	930	961	900
3	30	30	900	900	900
4	29	30	870	841	900
5	28	30	840	784	900
6	30	27	810	900	729
7	33	28	924	1089	784
8	30	33	990	900	1089
9	23	24	552	529	576
10	22	23	506	484	529
11	20	21	420	400	441
12	17	21	357	289	441
13	20	15	300	400	225
14	22	20	440	484	400
15	6	7	42	36	49
16	10	12	120	100	144
17	15	13	195	225	169
18	16	17	272	256	289
19	9	6	54	81	36
20	7	5	35	49	25
Total	$\sum X = 430$	$\sum Y=425$	$\sum XY=10613$	$\sum X^2=10732$	$\sum X^2=10615$

$$r_{xy} = \frac{N\sum XY - \sum X\sum Y}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}}$$

$$= \frac{20 \times 10613 - 430 \times 425}{\sqrt{20 \times 10732 - (430)^2}\sqrt{20 \times 10615 - (425)^2}}$$

= 0.96 (which is highly reliable).

Appendix E

Statistical Formula Used in this Study

S.N.	Subject	Symbol	Formula
1	Mean	$\bar{X}$	$\frac{fx}{N}$ Where X random variable and f= frequency
2	Variance	S^2	$\frac{fd^2}{N} - \left(\frac{fd}{N}\right)^2$
3	Pooled variance	S_P^2	$\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}$
4	Standard Deviation	S	$\sqrt{\frac{fd^2}{N} - \left(\frac{fd}{N}\right)^2}$
5	Pearson's Correlation Coefficients	r_{xy}	$\frac{N\sum XY - \sum X\sum Y}{\sqrt{N\sum X^2 - (\sum X)^2}\sqrt{N\sum Y^2 - (\sum Y)^2}}$
6	t-Distribution	T	$\frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{(n_1-1)S_1^2+(n_2-1)S_2^2}{n_1+n_2-2}}\sqrt{\frac{1}{n_1}+\frac{1}{n_2}}}$ Where, $\bar{X}_1$ and $\bar{X}_2$ are mean of experimental and control group respectively. S_1^2 And S_2^2 are the variances experimental and control group respectively.